

INSPECTION RPTS / COMPL MONITORING



2855

STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

ARCH A. MOORE, JR.
Governor

Division of Water Resources
1201 Greenbrier Street
Charleston, WV 25311
(304) 348-5935

May 22, 1985

WVA COMPLIANCE SECTION
RECEIVED
MAY 31 1985

RONALD R. POTESTA
Director
MICHAEL A. FOTOS
Deputy Director

Mr. Ken Walborn
PPG Industries, Natrium Plant
P. O. Box 191
New Martinsville, West Virginia 26155

Re: CEI (WVD004336343)
April 22, 1985

Dear Mr. Walborn:

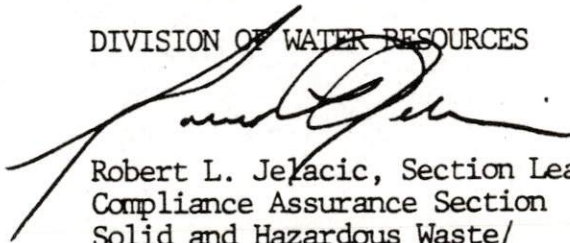
Enclosed is a copy of the "Compliance Evaluation Inspection" (CEI) Report completed on your facility by representatives of West Virginia's Division of Water Resources. This report is based on the inspection conducted on April 22, 1985.

There were no areas of non-compliance of the appropriate Hazardous Waste Regulations documented during this inspection.

Thank you for your assistance and cooperation during this inspection. If you should have any questions concerning the inspection or attached report, please feel free to call.

Very truly yours,

DIVISION OF WATER RESOURCES


Robert L. Jelacic, Section Leader
Compliance Assurance Section
Solid and Hazardous Waste/
Ground Water Branch

RLJ/ms
Enclosure

cc: Douglas Donor, US EPA, Region III, Philadelphia
Lynne Sakach, WV DWR

INSPECTION FACT SHEET

Company Name: PPG Industries, Natrium Plant

I.D. #: WVD004336343

Address: P.O. Box 191
New Martinsville, WV 26155

Type Operation: Gen, TSD

Company Contact: Ken Walborn

Title: Manager, Enviromental Control

Phone: (304) 455-2200

Purpose of Inspection: Compliance Evaluation Inspection (CEI)

Applicable Regulations: Chapter 20, Article 5E of the WV Code (effective April 23, 1982) and 40 C.F.R., Part 260-265 (FR: Feb. 26, and May 19, 1980).

List of Hazardous Wastes: D002, D003, D008, D009, F001, F003, F005, K073,
K085, K106, D001

Date Inspected: April 22, 1985

Inspector(s): Lynne Sakach, WV DWR
Pam Beltz, WV DWR
Jerome Cibrik, WV DWR
Lucy Pontiveros, WV DWR

Date Prepared: April 23, 1985

Prepared by: Lynne Sakach



Figure 1
Location Map for the PPG Industries Plant Site at Natrium, West Virginia

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Location Map

Inspection Report

Attachments:

A - Site Map

B - Checklist - Generators

C - Checklist - TSDF

D - Checklist - Use and Mangement of Containers

E - Checklist - Surface Impoundments

INSPECTION REPORT

SUBJECT: Compliance Evaluation Inspection (CEI), PPG Industries,
Natrium Plant (WVDOO4336343). April 22, 1985

INSPECTORS: Lynne Sakach and Pam Beltz, Compliance Section
Jerome Cibrik and Lucy Pontiveros, Permits Section

DATE PREPARED: April 23, 1985

PREPARED BY: Lynne Sakach

On April 22, 1985 at 10:00 a.m. this inspector accompanied by Pam Beltz, Jerome Cibrik and Lucy Pontiveros, all representatives of the W.V. Division of Water Resources, arrived at the above referenced facility. The purpose of our visit was to conduct a compliance evaluation inspection with a review of their ground water monitoring (Jerome Cibrik) and Part B Permit Application (Lucy Pontiveros).

Upon our arrival, we were met by Ken Walborn, Manager, Environmental Control, who had been notified earlier of our intentions to inspect this facility. Mr. Walborn escorted us to a conference room where we were introduced to William Makris and Robert Mitchell, Environmental Control Specialists, and Warren Dean, Head, Technical Department.

Appropriate credentials were presented and I explained our intentions of conducting a compliance evaluation inspection as specified under Chapter 20 of the State Code. I further related that our authority to conduct this inspection, and the protection of trade secrets and confidential information, are also covered under this Chapter. Mr. Dean then left the conference room and we proceeded with the inspection.

Initially, I inquired about any changes that have occurred at the facility since the last CEI. Mr. Walborn related that other than the approved closure of the tank car (S02), due to be completed in July, 1985,

no changes have occurred. Mr. Walborn then commenced to give a synopsis of the waste generation processes and subsequent handling methods.

The storage processes employed at this facility are S01 and S04. There are two drum storage areas, the CS₂ site and the Marshall Plant site. The one surface impoundment is utilized for the storage of waste water treatment sludge generated from the mercury cell process in chlorine production. One other waste generated at this facility, lead waste water treatment solids from diaphragm cell process in chlorine production, is stored on-site for less than ninety days. This waste is listed as D008 and D003 on the 1983 Biennial Report and the Hazardous Waste Manifests. In a telephone conversation on April 23, 1985 I asked Mr. Walborn to explain why this waste is listed as reactive. The question was relayed to Mr. Mitchell who in turn explained that this was done because the waste contains a small amount of sulfide. According to waste analyses maintained at the facility, the sulfide is in the form of PbS and the maximum concentration of this compound is 1%. I questioned the necessity for listing this waste as reactive and advised that after receiving clarification, I would notify them of my findings.

We then proceeded to partially complete the checklists for Generators, T.S.D. Facilities, Container Storage and Surface Impoundments. While inspecting the appropriate records (particularly the hazardous waste manifests) it was noted that an alternate facility was not designated on the form. I inquired as to how a shipment would be handled if the transporter was unable to deliver it to the primary designated facility.

We were informed that the transporter would return the shipment to them. I advised the gentlemen to include these instructions in written form on the manifests, to provide documentation should a problem arise in the future.

After partial completion of the checklists, we proceeded to physically inspect the hazardous waste management areas: the CS₂ drum storage area, the Marshall Plant drum storage area, the temporary storage area for the lead waste and the surface impoundment.

Few concerns were noted while inspecting these areas. Some water was observed on the floor beneath the pallets in the temporary storage area. A few of the boxes (containing the waste) appeared to be damp stained around the lower corners.

Also noted and discussed was the practice of stacking the drums three high in the Marshall Plant storage area. It was determined that this matter would be addressed during the technical review of the Part B Permit Application.

In summary, no major problems were noted at this facility. All records were in order and were well organized. The facility representatives were very cooperative and receptive to all suggestions. After thanking the gentlemen we concluded the inspection and left the facility.

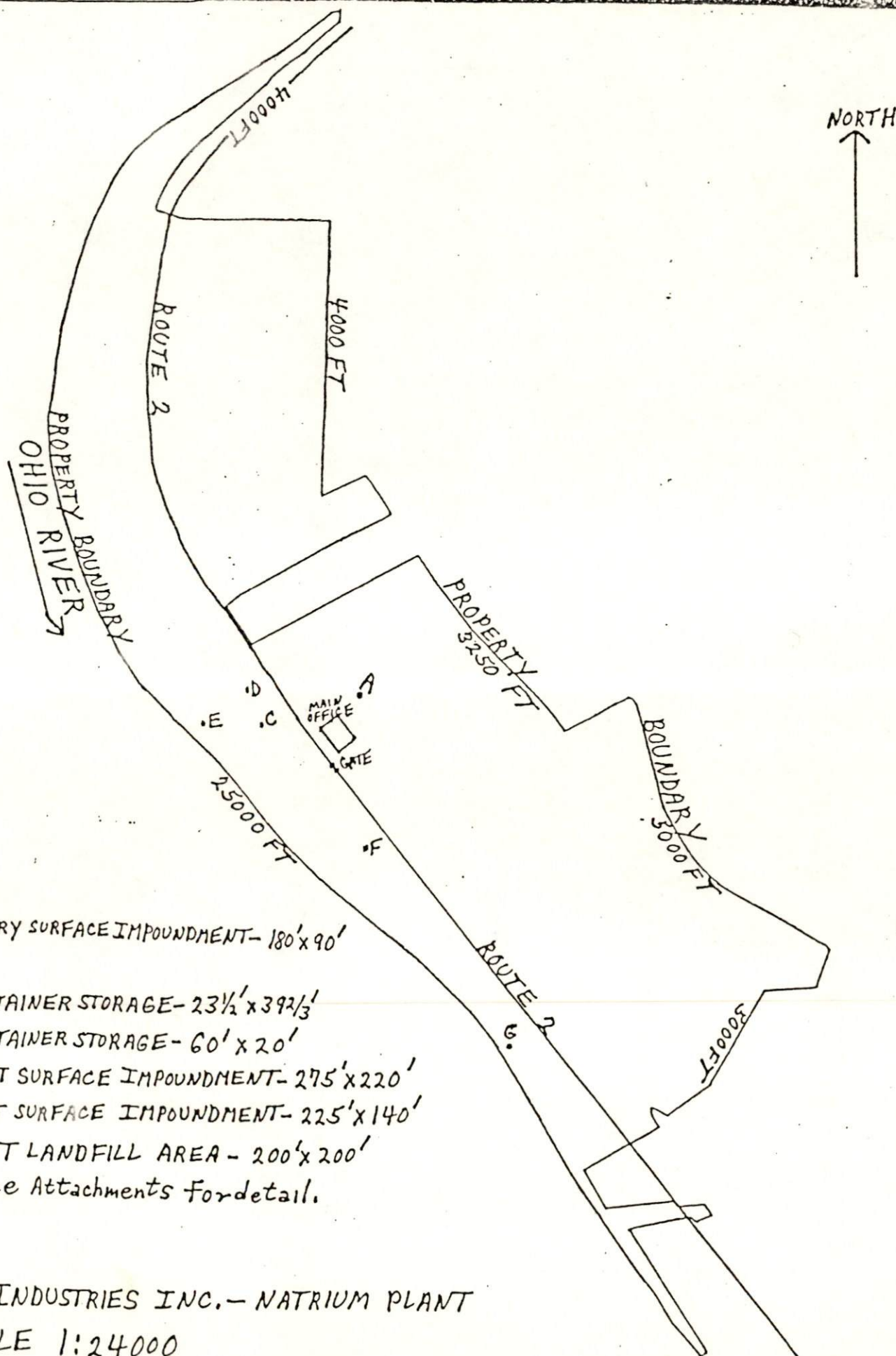
NOTE: In a telephone conversation on April 25, 1985 I spoke with Mr. Mitchell about the lead waste (D008) also listed as reactive(D003). According to him the process generating the waste will be

CEI - PPG Industries, New Martinsville, WV
April 25, 1985
Page Four

phased out this summer, therefore, making the necessary determinations to delist it as D003 would be impractical at this time.

Compliance Evaluation

No deficiencies were noted at this facility.



PPG INDUSTRIES INC. - NATRIUM PLANT

SCALE 1:24000

RCRA CHECKLIST FOR INSPECTION OF GENERATORS

Name of Facility: PPG Industries

Address: P.O. Box 191

New Martinsville WV 26155

EPA Generator ID Number: WV0004336343

Facility Inspection Representative: Ken Walborn

Title: Manager, Environmental Control

Telephone Number: 304-455-2200

RO USE

Inspection file

No. _____

Reviewer _____

Date Reviewed: _____

Form "A"

Pert. Regs.

40 C.F.R.

1. Please provide a brief narrative explaining the type of work activity that occurs at the generator.

2. Does the generator dispose of its wastes....

A. On-site

(Circle one)

☒ B. Off-Site

Note: If on-site, then checklist for both a generator and TSD facility must be completed if on-site more than 90 days.

3. Are 1000 kg (2200 Lbs) or more of hazardous waste produced by the generator facility in a month? (If the amount is less than 1,000 kg/month, then the facility qualifies as a small generator and Form C should be completed instead of Form A.)

Yes ☒ No

4. What categories of hazardous wastes result from the generator's facility?

A. Ignitable wastes

Yes ☒ No

B. Reactive wastes

Yes ☒ No

C. Corrosive wastes

Yes ☒ No

D. EP Toxic wastes

Yes ☒ No

E. RCRA Listed Wastes

Yes ☒ No

Types K073 F001 D002
K085 F003-F005 D009
K106 D001 D008 (temp)

5. Is the generator presently...

A. Treating hazardous waste?

Yes ☒ No

B. Storing hazardous wastes longer than 90 days?

Yes ☒ No

C. Disposing hazardous waste?

Yes ☒ No

Note: If the generator performs any of the activities noted in Question 5, then the inspector must complete Form B, entitled "RCRA Checklist for inspection of hazardous waste treatment, storage and disposal facilities."

6. In a manifest system currently in operation at the generator's facility so that offsite shipment of hazardous wastes can be tracked?

Yes ☒ No

7. Please inspect the generator's manifest for the following information

262.20

- A. Is the TSD facility which receives a generator's hazardous waste identified by name, address, and EPA ID number?

Yes No

262.20

- B. Is an alternative facility designated in case of an emergency? (Optional)

Yes No

- C. Is a serialized manifest document number included on the form?

Yes No

262.21

- D. Is the generator's name, address, telephone number and EPA ID number included on the form?

Yes No

- E. Is the name and identification number of each transporter included on the form?

Yes No

- F. Is a description of the generator's hazardous waste to be treated, stored, or disposed included on the manifest?

Yes No

- G. Is the quantify of each waste by units of weight or volume and the type and number of containers loaded in the transport vehicle included on the manifest form?

Yes No

- H. Is the following certification noted on the generator's manifest form and is the certification acknowledged by the generator's signature.

Yes No

"This is to certify that the above-named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to the available regulations of the DOT and EPA."

262.22

- I. Are there adequate copies of the manifest available for generator, transporter, and TSD's?

Yes No

- 262.34(a)(1) 8. Is all hazardous waste being shipped off-site by the generator within 90 days to a designated facility or placed in an on-site facility either of which has interim status or a Federal hazardous waste treatment, storage or disposal permit? ☒ Yes No
- 262.34(a)(3) A. Is the date accumulation of waste began clearly marked on each container? ☒ Yes No
- 262.34(a)(2) B. Are storage containers or tanks in good condition, i.e., no corrosion, leaking or structural deformations? ☒ Yes No
- C. Starting at the time of initial accumulation are the storage containers
- 262.34(a)(4) 1) Labeled ☒ Yes No
- 262.34(a)(4) 2) Marked ☒ Yes No
- 262.34(a)(2) 3) Packaged ☒ Yes No
- as containing a particular hazardous waste in accordance with DOT regulations?

Questions 9-15 apply to generators who accumulate wastes in a non-permitted facility.

- 265.16(a) 9. Have facility personnel successfully completed a program of classroom training or on-the-job training in hazardous waste management procedures? Yes No
- 265.16(d) 10. Does the generator facility maintain a record of job titles for personnel that are involved with hazardous waste management and the name of the employee filling each job? Yes No
- 265.16(d)(2) 11. Does the generator facility have on record a written position description for each job title noted in Question #10? Yes No
- 265.16(d)(3) 12. Does the facility presently maintain a written description of the type and amount of introductory and continuing training for those employees noted in Question #10? Yes No

265.32(a)

13. Does the generator facility have installed the following equipment:

- | | | |
|----|--|--------|
| A. | An internal communications or alarm system capable of providing immediate emergency instructions to facility personnel if the hazardous waste storage area is threatened by fire or explosion? | Yes No |
| B. | A device at the scene of hazardous waste generator operations capable of summoning emergency assistance from Police, Fire departments, etc.? | Yes No |
| C. | Fire control equipment and an adequate supply of fire fighting water or fire suppression chemicals? | Yes No |

265.35

- | | | |
|-----|---|--------|
| 14. | Does the generator facility have adequate aisle space to allow the unobstructed movement of personnel and equipment during emergencies? | Yes No |
|-----|---|--------|

265.50

15. Does the facility have a contingency plan which contains the following elements:

- | | | |
|----|---|--------|
| A. | Detailed description of emergency procedures facility personnel will implement in response to fires, explosions, or unplanned releases of hazardous wastes to air, soil, and water? | Yes No |
|----|---|--------|

265.52(c)

- | | | |
|----|---|--------|
| B. | A detailed description of arrangements formally agreed to by local police, fire departments, and State and local emergency teams to provide assistance during emergency situations? | Yes No |
|----|---|--------|

265.52(d)

- | | | |
|----|---|--------|
| C. | A listing of names, addresses, and phone numbers of the generator facility emergency response coordinators? | Yes No |
|----|---|--------|

Note: This listing should include names and phone numbers of emergency coordinators available on twenty-four hour basis.

265.52(e)

- | | | |
|----|---|--------|
| D. | A list of appropriate emergency equipment necessary to cope with emergencies at the generator facility? | Yes No |
|----|---|--------|

265.53

16. Has a copy of the contingency Plan been submitted to local police, fire departments, hospitals, and emergency response teams that may be called on to provide emergency services.

Yes No

17. Please provide detailed explanation or comments on specific questions or problems encountered during the inspection. For instance, industry requests for exclusions from optional portions of the regulation or for clarification of specific RCRA rules and regulations and their applicability at the facility can be noted below or described in a separate memo attached to the inspector's checklist.

Inspector's Name:

Jynne Spach

Title:

Water Resources Inspector

Agency:

W.V. D.W.P.

Office

location:

Parkersburg

Date of

Inspection:

April 22, 1985

Inspector's Name:

Title

Office

Location

Date of

Inspection:

Name of Facility: PPG Industries
Address: P.O. Box 191
New Martinsville, WV 26155
EPA TSD ID Number: WV D004336343
Facility Inspection Representative: Ken Walburn
Title: Manager, Environmental Control
Telephone: 304-455-2200

Inspection File
No. _____
Reviewer _____
Date reviewed _____
Form "B"

SITE CHARACTERIZATION

(Please denote if the facility presently treats, stores, or disposes of hazardous waste. Also, mark the appropriate sub-category that occurs at the particular facility.)

TREATER

☐ Filtration
☐ Incineration
☐ Thermal Reduction
☐ Recycling/Recovery
☐ Chem/Phys/Bio Treatments
☐ Waste Oil
☐ Reprocessing
☐ Solvent Recovery
☐ Other _____

STORER

☐ Open Pile
☒ Surface Impoundment
☒ Drum
☒ Above ground tank(s)
☐ Below ground tank(s)
☐ Other _____
☒ Tank car under closure

DISPOSER

☐ Landfill operation
☐ Land treatment
☐ Surface Impoundment
☐ Other _____

INSPECTION PROCEDURE

1. Does the facility generate hazardous waste?

Yes

Note: Please complete the generators checklist, Numbers 1 thru 8, if the TSD facility generates hazardous wastes which are disposed off-site.

2. Does the on-site or off-site facility have a written waste analysis plan?

Yes

3. Does the TSD facility have a 24-hour surveillance system which monitors and controls entry to the active portion of the facility?

Yes

If Not

- A. Does the facility have an artificial or natural boundary which surrounds active portions of the facility and,

- B. Does the facility have means to control entry at all times, i.e., gates, attendants, locked entrances, etc.?

Yes

4. Does the TSD facility have a restricted access sign posted at each entrance to the active portion of the facility? An example would be: "Danger-Unauthorized Personnel Keep Out!"

Yes

- 15 5. Does the TSD facility have a written schedule for inspecting all emergency equipment and monitoring equipment, security devices, and operating and structural equipment. ☒ Yes No
- 16(a) 6. Have facility personnel successfully completed a program of classroom training or on-the-job training in hazardous waste management procedures? ☒ Yes No
- 16(d) 7. Does the TSD facility maintain a record of job titles for all personnel that are involved with the handling of hazardous waste and the name of the employee filling each job? ☒ Yes No
- 16(d) 8. Does the TSD facility have on record a written position description for each job title noted in Question #7? ☒ Yes No
- 16(d) 9. Does the facility maintain a written description for the type and amount of introductory and continuing training for those employees noted in Question #7? ☒ Yes No
- 32 10. Does the TSD facility have installed the following equipment:
- A. An internal communications or alarm system capable of providing immediate emergency instructions to facility personnel if the hazardous waste storage area is threatened by fire or explosion? ☒ Yes No
- B. A device at the scene of hazardous waste TSD operations capable of summoning emergency assistance from Police, Fire departments, etc.? ☒ Yes No
- C. Fire control equipment and an adequate supply of fire fighting water or fire suppression chemicals? ☒ Yes No
- 35 11. Does the TSD facility have adequate aisle space to allow the unobstructed movement of personnel and equipment during emergencies? ☒ Yes No
- 52(a) 12. Does the facility have a contingency plan which contains the following elements: ☒ Yes No
- 52(c) A. A detailed description of emergency procedures facility personnel will implement in response to fires, explosions, or unplanned releases of hazardous wastes to air, soil, and water? ☒ Yes No
- 52(d) B. A detailed description of arrangements formally agreed to by local police, fire departments, and State and local emergency teams to provide assistance during emergency situations? ☒ Yes No
- 52(d) C. A listing of names, addresses, and phone numbers of the TSD facility emergency response coordinators?
Note: This listing should include names and phone numbers of emergency coordinators available on twenty-four hour basis. ☒ Yes No
- 52(e) D. A list of appropriate emergency equipment necessary to cope with emergencies at the TSD facility? ☒ Yes No

55	13. Does the facility have at all times at least one employee either on-call or on the site who is responsible for coordinating all emergency response measures?	<input checked="" type="radio"/> Yes	<input type="radio"/> No
	14. Does the on-site or off-site facility have a written operating record which contains the following information:		
73(b)(1)	A. A description and the quantity of each hazardous waste received/managed at the on-site or off-site treatment, storage or disposal facility.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
73(b)(2)	B. The location of each hazardous waste managed at the on-site or off-site facility.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
73(b)(3)	D. Copies of facility specific waste analysis as required by §§ 265.193, 265.225, 265.252, 265.273, 265.345, 265.375 and 265.402.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
73(b)(3) & 13	C. Written results of all chemical/Physical analyses of each waste treated, stored or disposed of at the facility.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
73(b)(4)	E. Summary reports of incidents requiring implementation of the contingency plan. <i>No incidents to date</i>	<input type="radio"/> Yes	<input checked="" type="radio"/> No
73(b)(3) & 15(d)	F. Records and results of all inspections (see #5) in an inspection log or summary.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
73(b)(6)	G. Results from groundwater monitoring (For surface impoundments, land treatment or land disposal facilities).	<input checked="" type="radio"/> Yes	<input type="radio"/> No
73(b)(7)	H. Closure cost estimate.	<input checked="" type="radio"/> Yes	<input type="radio"/> No
	I. Post Closure cost estimate (land disposal facilities only)	<input type="radio"/> Yes	<i>N/A</i> <input type="radio"/> No
10	15. Has the TSD facility operator completed a written closure or post closure plan in order to meet the May 1981 date for implementation of these requirements?		
	Does the TSD facility have:		
	A. Written Closure Plan	<input checked="" type="radio"/> Yes	<input type="radio"/> No
	B. Written Post Closure Plan (land disposal Facility only)	<input type="radio"/> Yes	<i>N/A</i> <input type="radio"/> No
	16. Does the TSD facility receive waste from off-site generators?	<input type="radio"/> Yes	<input checked="" type="radio"/> No
	If yes, does the operator implement the following procedures:		
13(a)(4)	A. Inspect or analyze incoming wastes and compare with manifest for each shipment received at the facility.	<input type="radio"/> Yes	<i>N/A</i> <input type="radio"/> No
13(b)	B. Specify procedures in the waste analysis plan to carry out #16A.	<input type="radio"/> Yes	<input type="radio"/> No
71	C. Sign and date all manifest copies?	<input type="radio"/> Yes	<input type="radio"/> No
71	D. Return copies of the manifest to the generator and transporter?	<input type="radio"/> Yes	<input type="radio"/> No
71	E. Retain copies of all manifests at the facility for three years?	<input type="radio"/> Yes	<input type="radio"/> No

Questions 17-22 apply to surface impoundments, land treatment and land disposal facilities.

17. Has the operator installed a groundwater monitoring system which consists of: ☒ Yes ☐ No
- A. At least one well hydraulically upgradient at the limit of waste management area? Yes ☒ No ☐
- B. At least 3 wells hydraulically downgradient at the limit of the waste management area? *In process of resolving this problem* ☒ Yes ☐ No
18. Are all monitoring wells cased in a manner to prevent contamination of samples and groundwater? ☒ Yes ☐ No
19. Do wells monitor groundwater in the uppermost aquifer underlying the facility? ☒ Yes ☐ No
20. Has the operator developed and followed groundwater sampling and analysis plan? ☒ Yes ☐ No
21. Does the plan include methods for establishing concentrations of parameters characterizing... ☒ Yes ☐ No
- A. Groundwater Suitability (265.92(b)(1)) ☒ Yes ☐ No
- B. Groundwater quality (265.92(b)(2)) ☒ Yes ☐ No
- C. Groundwater Contamination (265.92(b)(3)). ☒ Yes ☐ No
22. Has the groundwater monitoring program been implemented by a qualified geologist or geotechnical engineer? ☒ Yes ☐ No
23. The inspector should check for the following conditions at the TSD facility:
- A. Open fires Yes ☐ No ☒
- B. Fumes or gases Yes ☐ No ☒
- C. Leaks or corrosion in containers or other storage structures Yes ☐ No ☒
- D. Leachate to receiving streams Yes ☐ No ☒
- E. Malfunction of equipment Yes ☐ No ☒
- F. Bulging drums Yes ☐ No ☒
- G. Excessive heat generation from storage facilities, lagoons, storage piles, etc. Yes ☐ No ☒
24. Please provide detailed comments and explanations on specific checklist items or problems encountered during the TSD facility inspection. For instance, industry requests for clarification of specific rules and regulations and their applicability at the facility can be noted below or described in a separate memo attached to the inspector's checklist.
-
-
-

Inspector's Name: Lynne Sakach

Title: Water Resources Inspector

Agency: W.V. D.W.R.

Office Location: Partersburg

Date of Inspection: April 22, 1985

Inspector's Name: _____

Title: _____

Agency: _____

Office location: _____

Date of Inspection: _____

RCRA Checklist for Use Management of Containers

(Subpart I Section 265.170 - "General Operating Requirements")

R.O. USE

Inspection file No:

Name of Facility: PPG IndustriesAddress: P.O. Box 191New Martinsville, WV 26155A Generator ID Number: WV 0004 3363 43Facility Inspection Representative: Ken WallbornTitle: Manager, Environmental ControlTelephone Number: 304-455-2200

Reviewer:

Date Reviewed:

Form "I"

The questions contained in this checklist apply to owners and operators of all hazardous waste facilities that store containers of hazardous waste, except as Section 265.1 provides otherwise.

rt. Regs.
C.F.R.
rt:

CS₂ + Marshall Plant Storage Areas

.171

1. Are all containers in good condition, i.e., not showing signs of leakage or corrosion or any other deterioration/deformation?

Yes No

.171

2. Are containers lined or made of materials compatible with hazardous wastes placed into them so that the container will not react or corrode with the hazardous wastes?

Yes No

.173(a)

3. Are all containers holding hazardous waste kept closed during storage?

Yes No

.174

4. Are areas where hazardous waste containers are stored inspected by the owner/operator at least once a week?

Yes No

.15(d)

5. Is an inspection log maintained?

.15(b)

Yes No

.176

6. Are containers holding ignitable or reactive waste located at least 50 ft. from the facility's property line?

Yes No

.177(a)

7. Are incompatible wastes placed in the same container? (See Appendix 5 for examples.)

Yes No

.177(c)

8. Are storage containers holding hazardous wastes which are incompatible with nearby materials stored in containers, tanks, piles, or surface impoundments separated by dikes, berms, walls, or other devices?

Yes No

Inspector's Name: Gynne Sakach
Title: Water Resources Inspector
Agency: W.V. D.W.R. /
Office location: Parkersburg
Date of Inspection: April 22, 1985

Inspector's Name: _____
Title: _____
Agency: _____
Office location: _____
Date of Inspection: _____

(Subpart K Section 265.222 "General Operating Requirements")

Inspection file No:

Name of Facility: PPG Industries

Reviewer:

Address: P.O. Box 191

Date Reviewed:

New Martinsville, WV 26155RCRA Generator ID Number: WV0004336343Facility Inspection Representative: Ken Wallborn

Form "K"

Title: Manager Environmental ControlTelephone Number: 304-455-2200

The questions contained in this checklist apply to owners and operators of facilities that use surface impoundments to treat, store, or dispose of hazardous waste, except as Part 265.1 provides otherwise.

Pert. Regs.
40 C.F.R.
Part:

265.222

1. Is 2 ft. of freeboard maintained in the surface impoundment?

☒ Yes ☐ No

265.223

2. Do all earthen dikes have protective covers (e.g., grass, shale or rock) to minimize wind and water erosion and to preserve dike structural integrity?

☒ Yes ☐ No

265.225(a)
(1) &
()

3. Are waste analyses conducted or written documentation obtained before placing a substantially different hazardous waste into a surface impoundment used for storage or treatment? *Only receives one waste type*

N/A
☐ Yes ☐ No

265.226(a)
(1)

4. Is the freeboard level inspected at least once each operating day? *Every Shift*

☒ Yes ☐ No

265.226(a)
(2)

5. Is the surface impoundment, including dikes and vegetation, inspected once per week to detect leaks or deterioration or failures in the impoundment?

☒ Yes ☐ No

6. Are the results of these inspections recorded in an inspection log or summary?

☒ Yes ☐ No

265.229(a)

7. Are ignitable or reactive wastes stored in a surface impoundment: If so,

Yes ☒ No

265.229(a)
(1)

- a) Is the waste treated, rendered, or mixed before or immediately after placement in the impoundment so that the resulting waste, mixture or dissolution of material no longer meets the definition of ignitable or reactive waste under parts 261.21 or 261.23 of the RCRA regulations?

N/A
Yes ☐ No

.230

b) Are incompatible wastes segregated in separate surface impoundments so that spontaneous reactions are avoided?

N/A
Yes No

Inspector's Name: Jymme Sakachi
Title: Water Resources Inspector
Agency: W.V. D.W.R.
Office location: Parkersburg
Date of Inspection: April 22, 1985

Inspector's Name: _____
Title: _____
Agency: _____
Office location: _____
Date of Inspection: _____



File 31
Called Mr. Walken
on 2/19/85
Said should go to state.

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

WVD 00 433 6343

Natrium Plant
Industrial Chemical Division - U.S.

February 12, 1985

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Ms. Carole Dougherty (3AW32)
U.S. Environmental Protection Agency
Facilities Management Section
Sixth & Walnut Streets
Philadelphia, PA 19106

Dear Ms. Dougherty:

Re: Annual RCRA Facilities Report

As required by 40 CFR 265.94(a)(2)(ii), the values for the groundwater contamination parameters listed in paragraph 265.92(b)(3) for the two 1984 semiannual sampling periods of the Natrium Plant mercury surface impoundment monitoring wells are presented in Table I.

The information concerning 1984 semiannual sampling of down-gradient wells (Table I) was previously reported and discussed in May 21 and August 27, 1984, notification letters to EPA Region III and West Virginia DNR.

Resampling of upgradient and downgradient wells was not performed on these parameters showing statistically significant differences since the groundwater quality assessment program interpretations presented in the December 22, 1983, assessment letter by Geraghty & Miller, Inc., groundwater consultants, indicated that these significant differences are not due to the mercury surface impoundment, but rather due to external influences.

It should be noted in Table I that the first 1984 semiannual sample for the background well (GM-0) for some unknown reason showed significant difference in specific conductivity, TOC, and TOX when compared to the 1982 background well samples.

The second semiannual sample for the background well (GM-0) showed significant difference for pH, specific conductivity, and TOC when compared to the 1982 background well samples (Table I).

EPA Region III filed a RCRA Complaint Docket No. RCRA III 096 against PPG on March 2, 1984, alleging monitoring system and procedural requirements deficiencies.

Ms. Carole Dougherty - EPA
February 12, 1985
Page 2

A settlement conference was held April 2 in Philadelphia, Pennsylvania, EPA Region III headquarters, and subsequently (May 2, 1984) PPG submitted information to address agency concerns and proposed a program which, if accepted by the State DNR and the EPA, would obviate the need for a formal hearing.

A second meeting was held August 16, 1984, in Charleston, W. Va., with EPA and DNR personnel to discuss this proposal.

On December 27 a tentative agreement was reached with EPA Region III and the State DNR. Assuming that a satisfactory technical proposal can be agreed upon, PPG will proceed with system modifications that will address alleged deficiencies and confirm the integrity of the impoundment.

This program will require drilling new wells and reestablishing background levels.

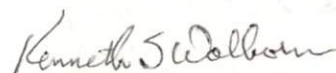
As required by 40 CFR 265.94(a)(2)(iii), the groundwater surface elevations for the downgradient monitoring wells for the 1984 semi-annual sampling periods are summarized in Table II. However, there is no direct comparison with the background well GM-0 since it is a plant pumping well located approximately two thousand feet northwest of the active surface impoundment and the downgradient wells GM-1, GM-2, and GM-6. Background well GM-0 is not a true upgradient well because the uppermost aquifer does not occur upgradient of the impoundment and the downgradient monitoring wells. Well GM-0 is virtually free of contamination and is situated so as not to intercept groundwater emanating from beneath the mercury surface impoundment.

Forms 8700-13A and 8700-13B representing PPG Industries Natrium Plant's RCRA Generator and Facility Biennial Hazardous Waste Reports required in alternate years under Subtitle C of RCRA were submitted for the year 1983 and are not required for the year 1984.

If there are any questions concerning this report, please contact me.

Sincerely yours,

PPG INDUSTRIES, INC.
Natrium Plant



Kenneth S. Walborn
Manager, Environmental Control

KSW/egm
Enclosures

1984 SEMIANNUAL WELL SAMPLING DATA VERSUS 1982 BACKGROUND WELL

¹ Statistically significant increase (or pH decrease) according to 40 CFR 265.93(b).

TABLE II

GROUNDWATER SURFACE ELEVATIONS REQUIRED BY 40CFR 265.94(a)(2)(iii)

(Relative to Mean Sea Level, Feet)

		1983 SEMI-ANNUAL			1984 SEMI-ANNUAL	
		<u>3/82</u>	<u>6/82</u>	<u>9/82</u>	<u>First</u>	<u>Second</u>
GM-1	<u>11/81</u>	611.1	610.9	611.6	611.9	612.7
GM-2	612.3	622.5	621.3	622.2	622.5	620.3
GM-6	623.6	642.4	636.7	633.0	653.7	622.0
	631.1				623.9	618.6
						623.7



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

File

DEC 20 1984

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

W. Ray Cunningham
Hazardous Materials Branch
Environmental Protection Agency
6th and Walnut Street
Philadelphia, PA 19106

Dear Mr. Cunningham:

As you are aware several site visits are being conducted in the Region to gather materials for our Phase III Interim Status Ground-Water Monitoring Implementation Study. Enclosed is the case history for PPG Industries prepared under the direction of Bill Myers, of my staff. This is provided to you for your information and review. While the case histories will not be included in the final document as separate entities, information from them, both for specific examples and to document trends, will.

This case history will be provided by us to the State for their review and comment in two weeks unless we hear from you regarding any errors you may have discovered. Furthermore, we will request that the State provide a copy to the facility after any corrections and additions are incorporated. If you wish to discuss anything in the study please feel free to contact Bill Myers at 382-4779.

RECEIVED
Facilities Management Section

JAN 3 1985

U.S. EPA, Region III

Enclosure

Sincerely,

George A. Garland

George A. Garland
Chief, Financial Responsibility
and Assessment Branch

RECEIVED
WASTE MGMT. BRANCH

JAN 4 1985

U.S. EPA, Region III

RECEIVED

DEC 26 1984

Air Management Div. (3AM00)

*File Under
PPG Industries
New Martinsville WV
WVD 00 433 6343*

INTRODUCTION

Site Activities

The plant is located on a .4 mile wide section of bottom land containing floodplain deposits and terraces adjacent to a large river (Figure 1). The facility is located in a temperate climatic setting, with average annual precipitation of approximately 40 to 42 inches. The plant produces a variety of inorganic and organic compounds. Chemicals produced at the site include the following:

- o Chlorine and caustic soda by diaphragm and mercury cells
- o Chlorinated benzene compounds
- o Carbon bisulfide
- o Sodium sulfide and sodium sulfhydrate
- o Anhydrous ammonia

Regulated Facility

The single RCRA regulated facility is a 12 foot deep lined impoundment, with areal dimensions of 80 feet by 190 feet. It sits on a level alluvial terrace remnant. The local topography slopes steeply both above and below the terrace. Liquid wastes consist of wastewater treatment sludge (K106) from the mercury cell process employed at the site. The mercury is precipitated as mercury sulfide in the impoundment, and the effluent is treated by carbon filtration before being discharged to the adjacent river. The carbon filtration is maintained as part of a state permit (granted prior to the development of the RCRA monitoring network) to achieve BAT limits. The sludge layer is periodically dredged from the bottom and removed. A plastic liner is employed as the containment system. In 1978, a 6" layer of bentonite clay was placed on the old liner and a second 30 mil HP flex seal liner was installed over the clay.

A water quality analysis of the clarified liquid from the mercury pond is summarized in Table 1.

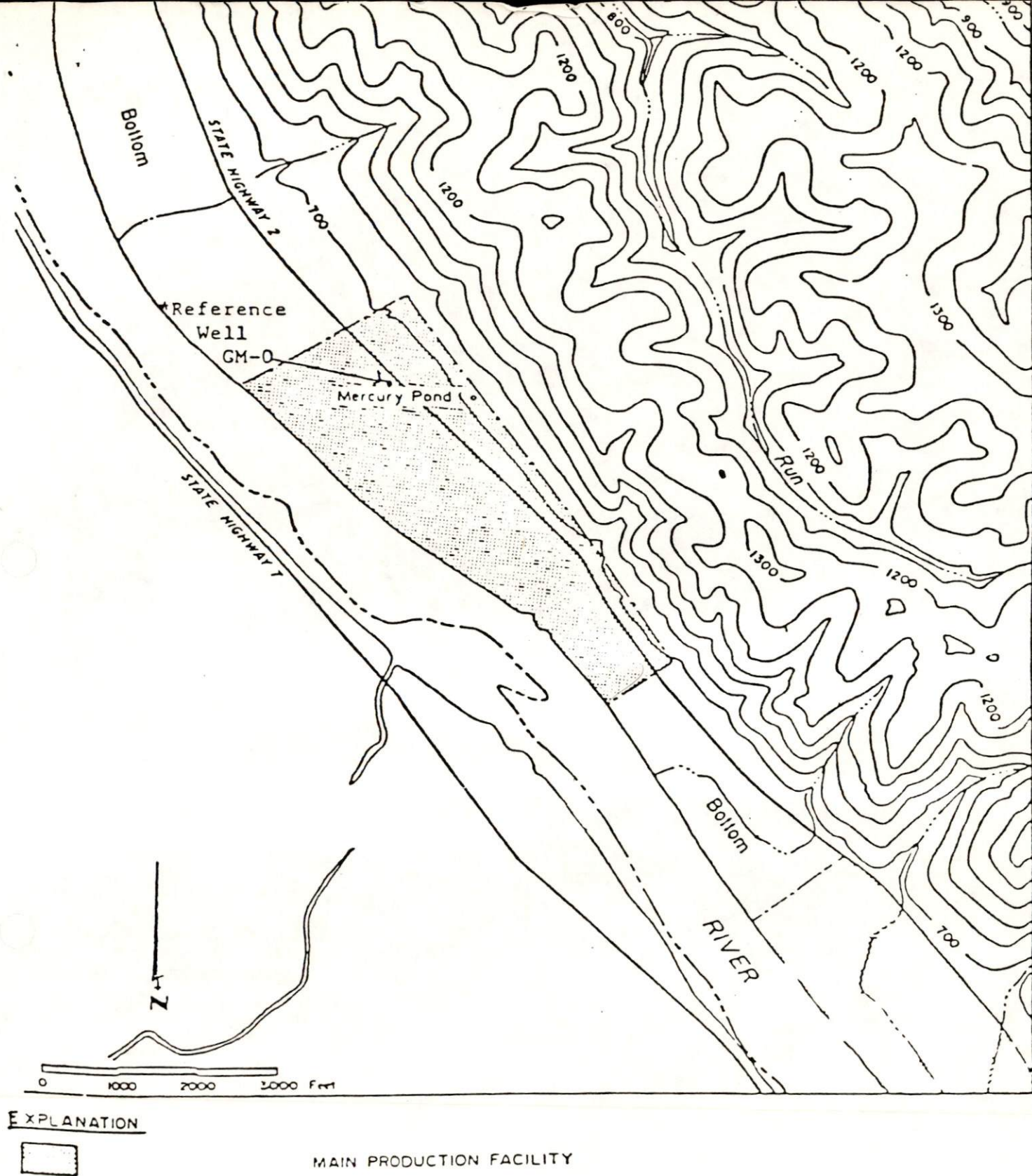


FIGURE 1, Location of Plant Site and Mercury Pond

The hydrogeological study performed prior to placement of the monitoring wells showed that there was no aquifer upgradient of this impoundment since it is located where the bedrock abruptly rises to a ridge above the impoundment. Since it was not possible to take an upgradient sample at the site, an existing well was chosen as the reference well (GM-0) to provide representative background groundwater quality in the uppermost aquifer of interest.

Table 1.

<u>Parameter</u>	<u>Concentration in mg/l (except color and pH)</u>	<u>EPA DWS</u>
Total dissolved solids	32,200	500
Laboratory pH	11	6.5-8.5
Color (APH)	0	
Sodium	8,764	
Calcium	16.2	
Magnesium	1.1	
Manganese	<.01	
Total Iron	.057	
Potassium	5.3	
Chloride	19,000	250
Sulfate	319	250
Alkalinity as CaCO ₃	306	
Alkalinity as HCO ₃	373	
Arsenic	<.005	
Barium	.032	
Cadmium	<.01	
Chromium (Total)	<.01	
Chromium (VI)	<.01	
Copper	<.01	
Lead	<.005	
Mercury	<.019	
Selenium	<.005	
Silver	<.01	
Zinc	.01	

Influent concentration levels would obviously be somewhat higher. Laboratory pH, total dissolved solids, chloride, and sulfate all exceed EPA primary or secondary drinking water standards.

Prior to its current use, the impoundment was used as a basin for sodium chloride brines. The facility was concrete lined and had been in operation for "several years" up until 1960.

During this period, the groundwater below the impoundment became contaminated as a result of leakage of the brines through the concrete impoundment liner. Indications are that some, if not much, of the original contamination still resides in the subgrade materials below the impoundment. For example, vegetation near the edge of the impoundment shows indications of stress, and a white efflorescence of salt can be observed at the soil surface near the impoundment during dry periods.

Regulatory Context

Pursuant to 40 CFR 265 Subpart F requirements, the facility initiated a hydro-geological study of the plant site in November 1980, and thereafter installed monitoring wells near the regulated unit. Four wells comprise the RCRA network. First quarter sampling results were submitted to the EPA Regional office in January 1982. Aside from Groundwater Contamination Indicators and Groundwater Quality Parameters, the site monitors for dissolved and total mercury and total dissolved solids. Due to difficulties in drilling an upgradient well that tapped the near-surface aquifer at the site, the facility designated an existing plant production well as the background monitoring well in the RCRA network. This selection was cited as one of several deficiencies in the monitoring well network by state regulatory personnel.

In a Compliance Order issued by the Regional EPA office in March, 1984, it was required that the following organic constituents be added to the list of sampling parameters:

- o 1,2-Dichloroethene
- o 1,1,2-Trichloroethane
- o Bromoform
- o Chloroform
- o Trichloroethene
- o Tetrachloroethene
- o Carbon Tetrachloride
- o Benzene
- o 1,4-Dichlorobenzene
- o 1,2-Dichlorobenzene

HYDROGEOLOGIC SETTING

Physiography and Soils

The plant site is situated on a series of alluvial and glacio-fluvial terraces which rise from a major river site located about 700-800 yards to the west of the regulated facility. The plant site lies at an elevation ranging from about 620 feet near the river to 700 feet at the base of dissected highlands rising to the east of the site.

Soils at the plant include fill materials and deep, well drained, stony, yellowish brown to grayish brown, alluvial and colluvial deposits. Permeability values for these soils range from 5.6×10^{-4} cm/sec to 3.5×10^{-3} cm/sec. The alluvial deposits may attain thicknesses of 120 feet below the terraces.

Bedrock and Surficial Geology

Bedrock under the site consists of terrestrial and marine sedimentary strata of Paleozoic age. A near-complete geologic section of the Paleozoic era is represented below the site. Lithologies range from sandstones, siltstones, and mudstones to freshwater and marine limestones, and coals.

Seven boreholes were drilled near the impoundment by a geotechnical consultant during late 1980. Locations of the boreholes, as well as the geologic cross-sections, are indicated in Figure 2. The geologic cross-sections are shown in Figures 3a and 3b. The cross sections indicate that the shallow sub-surface materials consist of a mixture of clay, silt, sand, gravel, and rock fragments overlying mudstone, siltstone, or sandstone bedrock. Depth to bedrock ranges from 50 to 100 feet below the ground surface at the site. The sediments suggest a colluvial or alluvial origin.

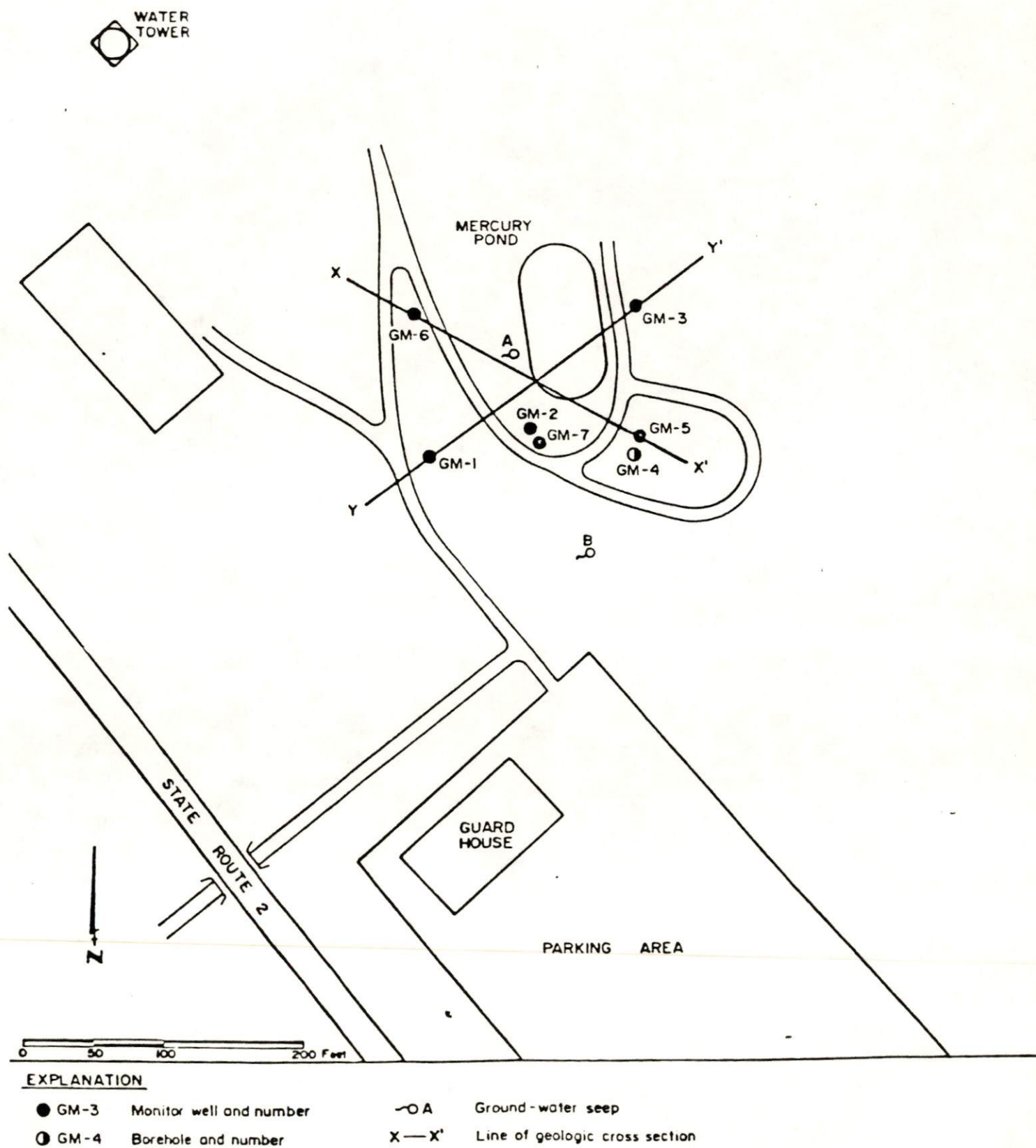


Figure 2. Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections

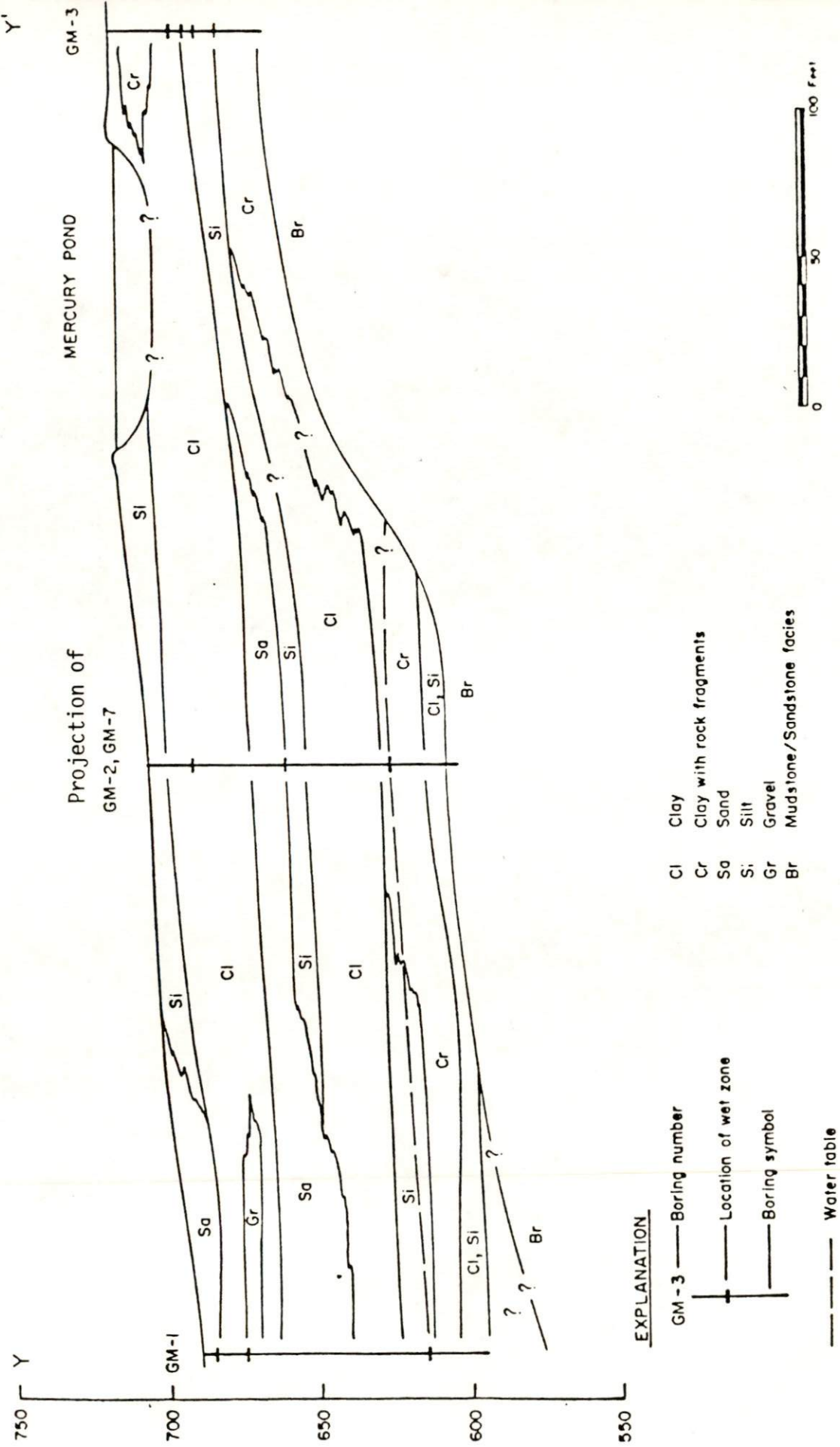


Figure 3a. Geologic Cross Section (Y-Y')



Figure 3b. Geologic Cross Section (X-X'),

At least two, more or less continuous, clay strata underlie the regulated unit. These units vary in thickness from 8 to 28 feet. Below the upper clay unit at depths of 20 to 30 feet below the surface, is a dry to occasionally moist brown sand layer, 10 to 15 feet in thickness. This, in turn, is underlain by a moist to wet, 4 to 12 foot thick silt layer, a thick clay unit up to 25 feet in thickness, and finally a basal silt unit above the bedrock contact. Vertical permeability values for clay and silt units below the impoundment (Table 2) were determined from Shelby tube samples in the laboratory and suggest fairly low groundwater velocities. However, in-situ horizontal permeabilities and those associated with coarser-grained sediments would be expected to be several orders of magnitude higher.

Surface and Subsurface Hydrology

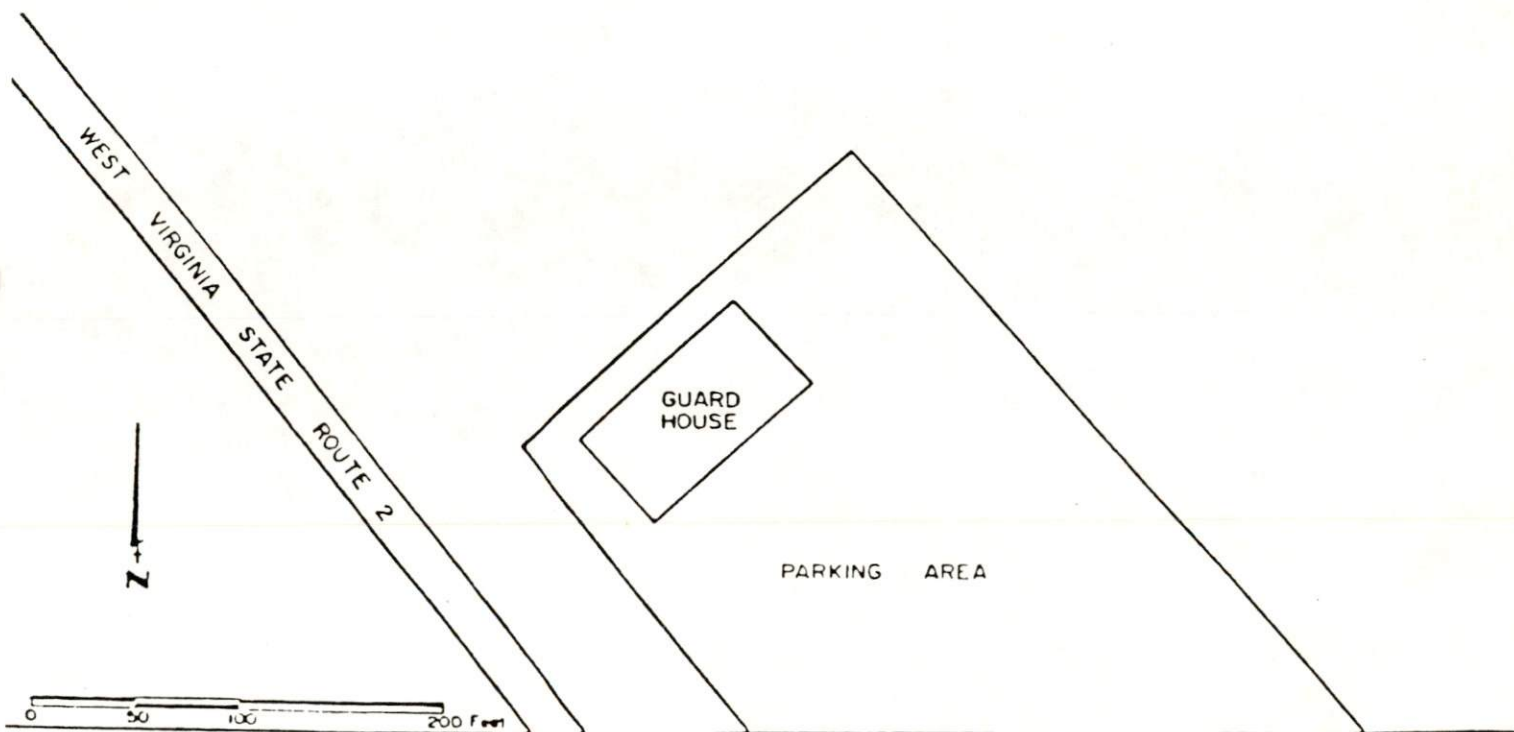
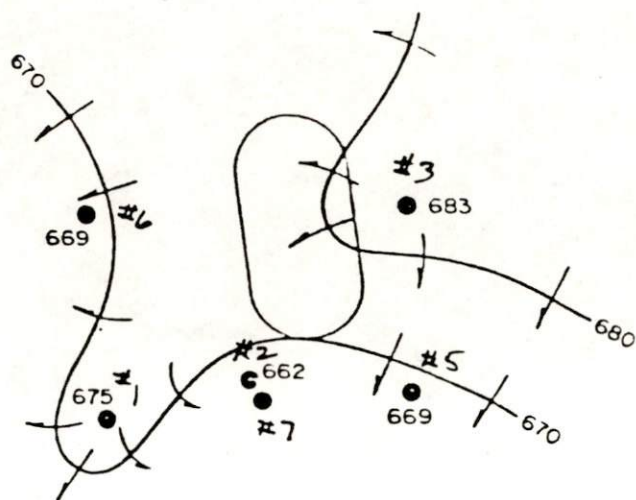
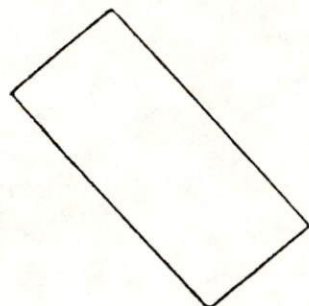
Intermittent streams drain surface water from the site toward the major river to the west. The streams by-pass the impoundment area. Surface seeps, as indicated in Figure 2, crop out along the side of the terrace upon which the impoundment sits. This represents the perched water table which underlies the impoundment and shows evidence of contamination. The perched condition is evidently not continuous, but is encountered in silt and sand lenses at depths of up to 30 feet below the surface. The moisture content of this layer varies seasonably, becoming saturated in the spring and early summer. Water table elevations in the perched horizon (Figure 4) suggest flow to the west and southwest.

A more productive semi-confined aquifer, located approximately 50 feet below the perched water table is associated with alluvial silt and fine sand deposits above the bedrock contact. The potentiometric surface of this aquifer (Figure 5) again suggests a predominant westward flow towards the major river. The water table resides in the alluvial sediments near the river, in colluvial deposits further east, and probably occurs in bedrock to the east of the impoundment. According to state regulatory officials there is a fair degree of hydraulic connection between the perched and deep alluvial horizons, owing to the discontinuous nature of the clay confining beds. The state regulatory authority considers both units to comprise a single near-surface aquifer.

TABLE 2. VERTICAL HYDRAULIC CONDUCTIVITIES OF SHELBY TUBE SAMPLES

Well Number	Depth Interval (ft)	Hydraulic Conductivity		Sample Description
		(cm/sec)	(ft/day)	
*GM-2	11-13	3.0×10^{-8}	8.5×10^{-5}	Clay, tight, plastic, brown and orange-tan, with weathered rock fragments, micaceous
GM-3	27-29	1.5×10^{-6}	4.2×10^{-3}	Silt, clayey, gray- green with brown mottles, wet

*sieve analyses also available for this sample



EXPLANATION

680 — Contour line showing bottom of
perched - water zone, in feet, msl

— Inferred direction of ground - water flow

● Monitoring point

675 Elevation of perched - water zone,
in feet, msl

Figure 4. Elevation of the Bottom of the Perched-Water Zone

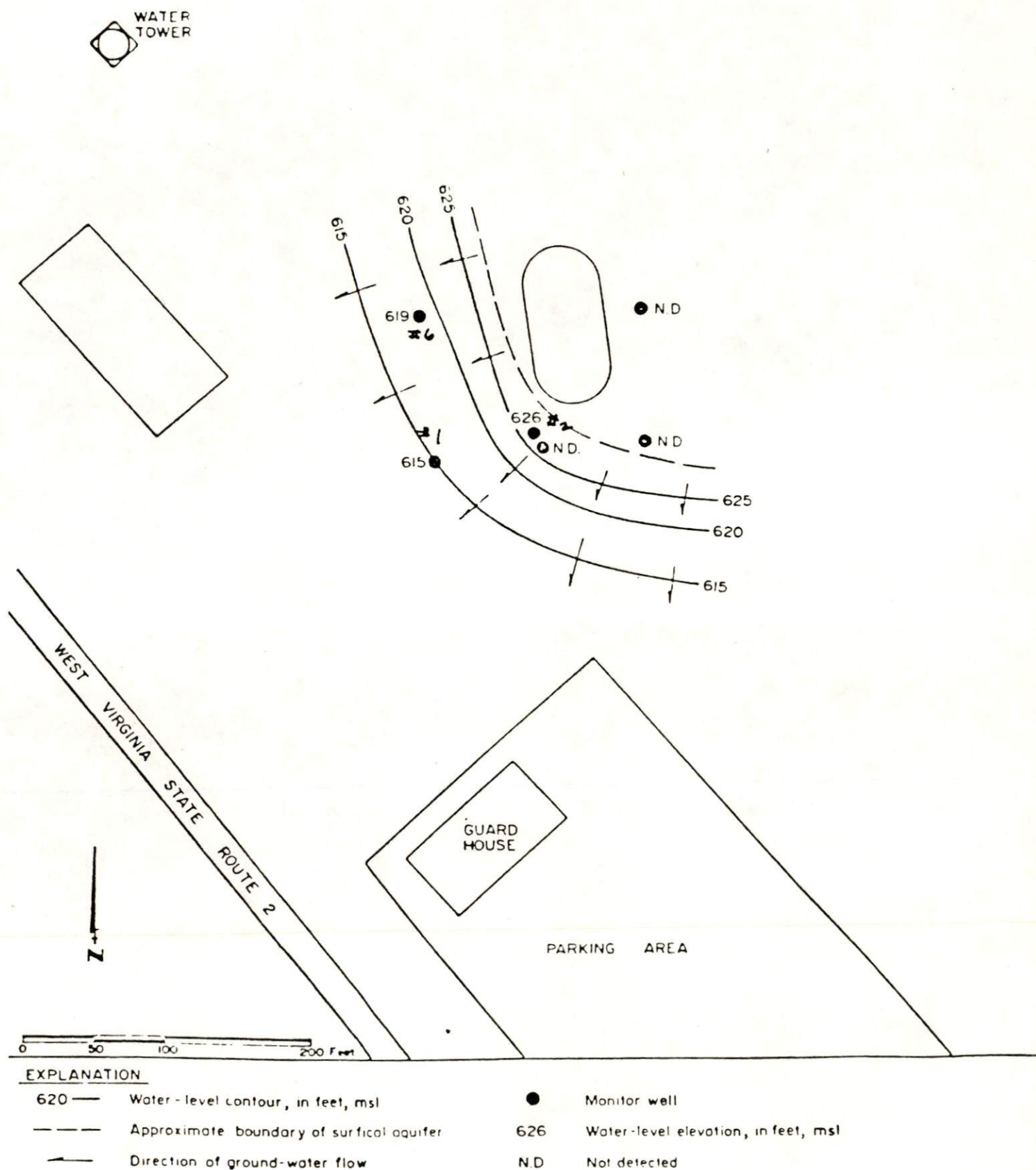


Figure 5. Water-level Contour Map of the River Alluvial Aquifer

Production wells at the site tap this aquifer for cooling and process water. They are located 1000 to 2000 feet west of the site and are pumped at a combined discharge of approximately 5 mgd. The background well (GM-0) is drilled to a depth of 85 feet. The pumping stresses result in a composite cone of depression some 10 to 15 feet below the normal river stage. Water levels in the monitoring wells located at the site are also affected by the pumping. Water levels are reduced by 2 to 30 feet below ambient levels. This again suggests the apparent hydraulic connection between shallow and deep portions of the subsurface materials.

Monitoring Well Network

Six monitoring wells were constructed in the latter part of 1980, using hollow stem auger techniques and a CME B-61 rig. Split spoon samples were taken at 5 foot intervals. Auger flights were washed between boreholes to avoid cross-contamination problems. This constitutes good drilling practice. Undisturbed Shelby tube samples that were taken in two boreholes were collected for laboratory analysis of hydraulic conductivity, as summarized in Table 2. Apparently, only the finer-grained horizons were tested for this parameter. It would have been instructive to also evaluate the sand and silt layers, in order to evaluate the potential for lateral migration of constituents below the impoundment. Three wells (GM-1, GM-2, and GM-3) monitor the deep alluvial aquifer, while the remainder monitor the shallow-perched groundwater horizon (Figure 6). Borehole GM-4 was not completed as a monitoring well. The wells in the alluvial aquifer comprise the three downgradient wells in the RCRA network. As discussed in a later section, a plant production well (GM-0) is currently being used as the "upgradient" well in the RCRA network (Figure 7).

Monitoring well logs are included in Appendix A, and details of the monitoring well construction are shown in Figure 8. Well construction consisted of 2 inch PVC casing and 0.008 inch slot PVC screen. The annulus was sealed with a gravel pack to at least 5 feet above the screened interval, a 1 foot bentonite layer above the gravel pack, a Portland cement grout layer, a layer of cuttings, and a second capping layer of cement grout. State regulations now require that the annular space be filled either with bentonite or neat cement grout (rather than

cuttings) along the entire depth of the well above the screened interval to insure against infiltration from the surface of the bore hole. Another potential problem regards the thickness of gravel pack in the well. Generally, a height of 5 feet above the top of the screen is sufficient for the gravel layer whereas some wells in the monitoring network show a thickness of 32 feet. In such wells, the effective length of the screening interval is effectively increased, which may cause dilution of formation waters during sampling. A 4 inch steel casing with a cap was cemented around the PVC casing to prevent precipitation and runoff from entering the monitoring well. The monitoring wells were apparently developed after installation. Although the PVC materials are probably acceptable for inorganic parameters, their use for organics is questionable; this because of the potential for adsorption/desorption of organic constituents in such materials. Several other concerns regarding the details of the monitoring well network can be cited, as discussed in the following section.

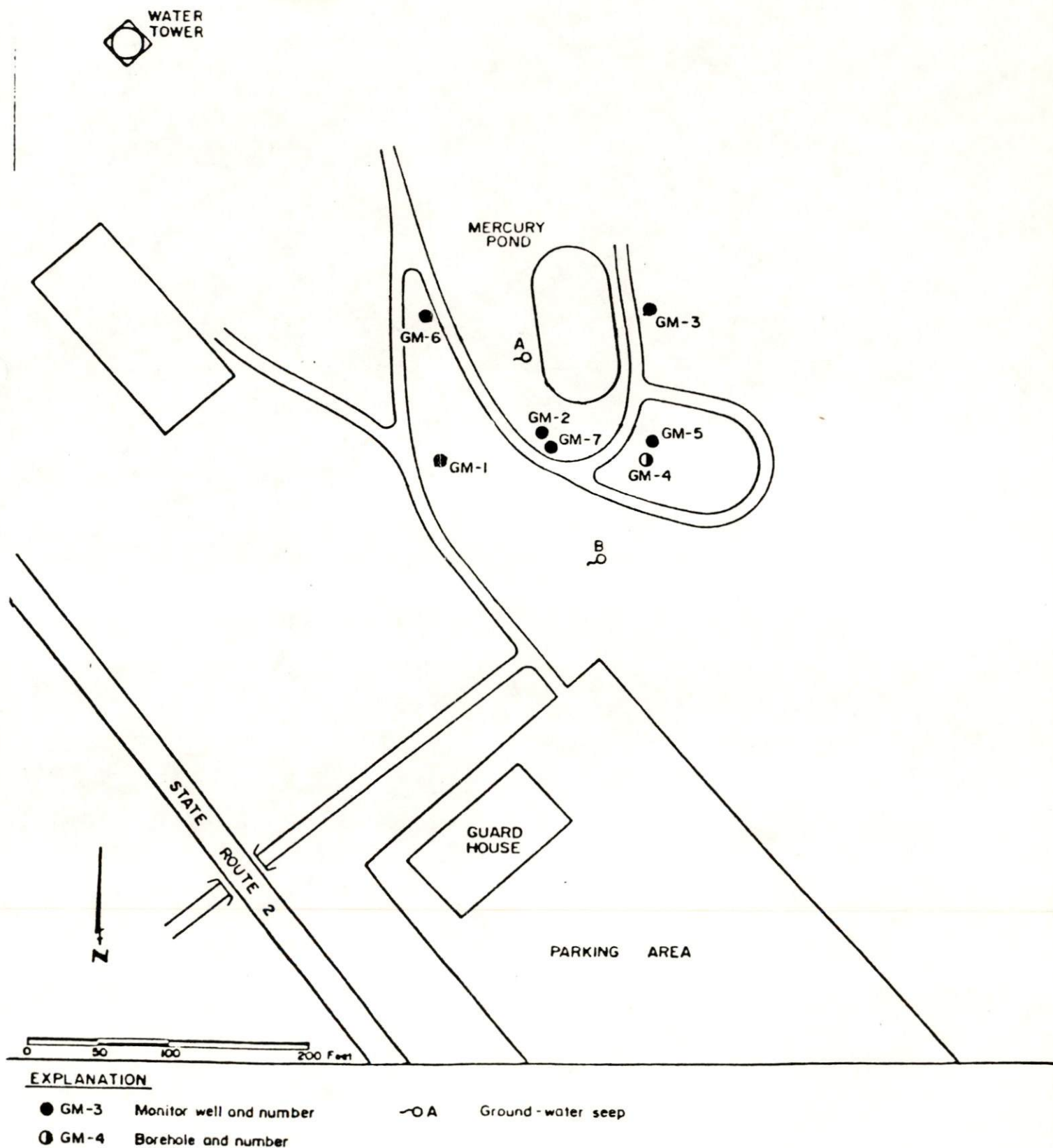


Figure 6. Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

2857

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

William L. Murphy Rohrer
Pope-Reid Associates, Inc.
245 East 6th St. Suite 813
St. Paul, MN 55101

Dear Bill:

Here are my comments on PPG Industries, Inc. Sorry about the delay in the review but things have been anything but calm around here recently. I am changing our procedures at this point to forward a copy of the draft with my comments to both the State and Region. I am asking that they review them and call you with any additional suggestions that they may have. If you do not hear from them by the 13th, assume they won't have any major comments and just react to mine.

Sincerely,

Bill

William Myers

COMMENTS

1. These values are apparently for the plant proper, not under the regulated unit. This should be made clearer here.
2. Could we by looking at water levels (presence of water) do a more detailed analysis of the flow regime here and whether we think the State is correct and why? In other words if you were to design the system where would you screen/place the wells you knew you were faced with a very aggressive compliance program. My own opinion is I believe there are problems at this site but they aren't easily remedied. For instance, what happens to the perched water? Does it essentially trickle onto the parking lot-- in which case do we care, or does it discharge every spring to the river? Also we need to change the wording here so as not to encourage large well screening intervals (greater than 10 feet) but to force nesting or clustering, which would appear to be appropriate here.
3. If there are organic constituents present, and the data does support this, then the site must use something other than water for cleaning.
4. Please comment on 5 day recovery. Suggest, if you also accept the argument, that 5 days (even one for that matter) is too long and they should sample as water becomes available-- first volatiles then other parameters. Since they are using their own people for the sampling this shouldn't be a problem.
5. Could you expand a little on this to indicate which. They use a gas bladder pump for both purging and sampling.
6. Any ideas on the coliform? For that matter any ideas on lead and cadmium for a facility that is sampling for mercury? Could the presence of coliform indicate that there may be a problem with improper sealing of the well annulus thus allowing run-off to penetrate to the water table?
7. This section needs to be re-done and expanded with closer attention given to the actual values. For instance:

Well GM-0		EPA	SITE
	Sulfate	87ppm	35ppm
	Copper	6.1ppm	<.01
	Iron	34	<.1
Well GM-1			
	Chloride	<.3	18
	Calcium	118	97.2
	Iron	34	.1

It would appear that some of the parameters are very close and some are not. We need to check run times and methods as well as whether they were both preserved before analysis to try to account for the differences. This would include whether they had an intermediate step in their transfer process that could have left some concentration of parameters behind on the sides of the transfer vessel.

8. They picked up quantifiable measures of benzene in all wells but GM-7 and ortho-dichlorobenzene in wells GM-6 and GM-7. Could you give me reasons why you say otherwise? Also look at methods and holding times for possible explanations on differences.

A. Do we know why they are using charcoal filtering for a mercury cell process? Was this treatment required by the State? and, if so, before or after they suspected organics were present?

B. We should probably mention here their problem with locating a suitable "up-gradient" well.

C. What depth are the production wells at compared to this semi-confined aquifer? My memory seems to be that they are deeper than the bedrock up on the terrace where the impoundment is and hence would have to be tapping a different, though probably connected, aquifer. Please check.

D. Since they pump the well (GM-0) at 100+gpm it can't be 2 inch PVC like the others are.

E. Is this the procedure for all bottles including VOA vials? If so, it is not appropriate since they generally require a solvent rinse and baking.

F. A finding of a statistically significant increase in TOC should result in GC/MS work that attempts to identify the individual constituents. If this was not done then the site is in violation of 265.93(d).

G. Did they identify what these are?

H. Provide me with a comparison Table that displays all the inorganic values and any positive organic ones.

I. Please read the laboratory report footnote. Metals were not requested on this well not, not detected by the EPA (there was not enough water for both of us). Make the appropriate changes.

NOTES ON THE SAMPLE AND ANALYSIS PLAN.

2.3.2(c) There is no if involved. They are sampling for organics. Hence the distilled water rinse is not appropriate, i.e., complete enough. They have not used teflon bailers, but these should appear in their list of equipment. If teflon is preferable to PVC for organics as they state in "c" then why are they using a pump with PVC (tygon) tubing.

2.3.3(a) Sample water for volatiles should be obtained as soon as there is sufficient water to do so-- a few hundred ml's.

2.3.3(e) I question the advisability of using one bottle for TOX and pesticides since one has to be treated as a volatile (TOX) and the other generally not.

They should state in the plan which parameters are to be done on-site and which by an off-site lab.

INTRODUCTION

Site Activities

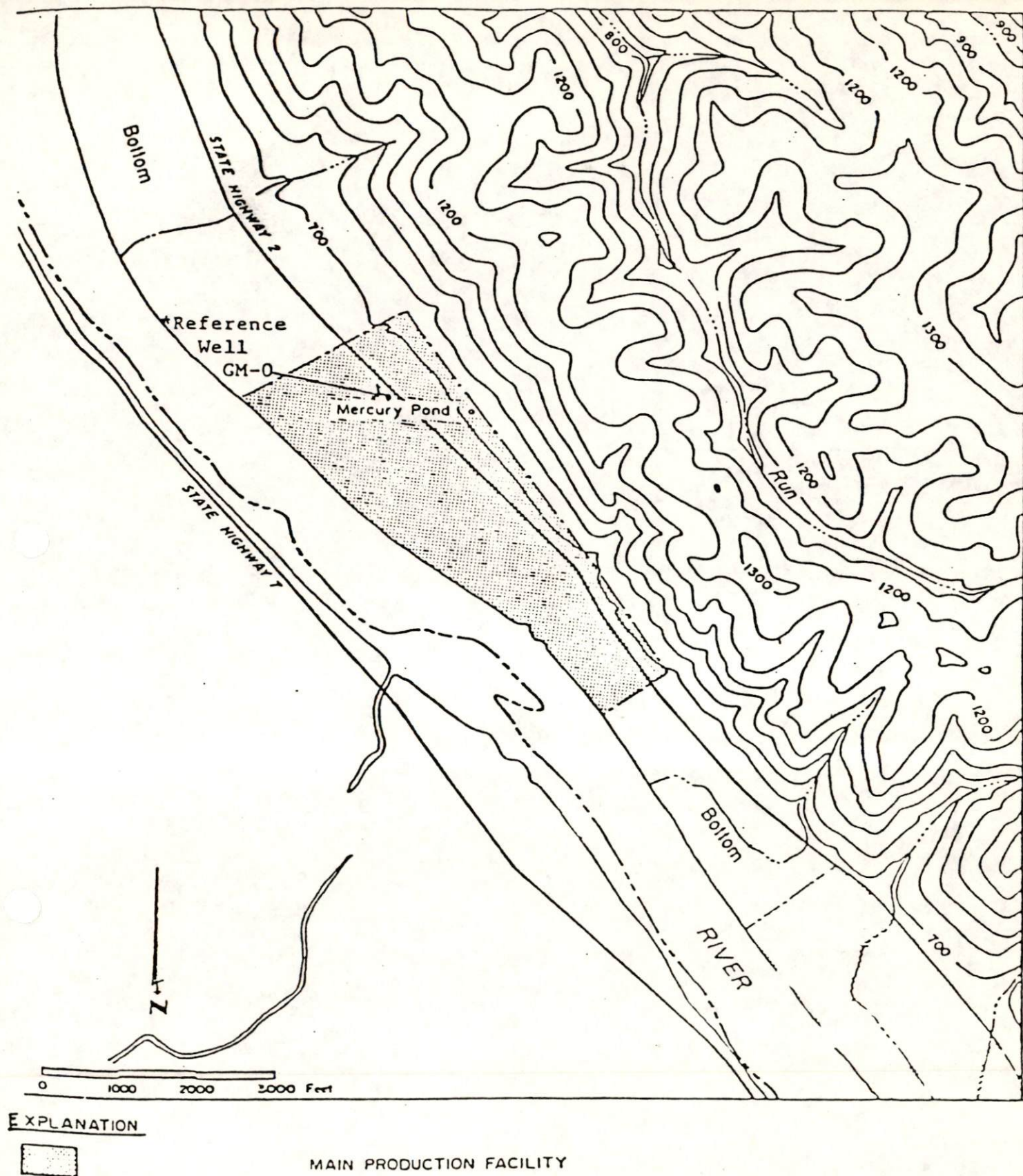
The plant is located on a .4 mile wide section of bottom land containing floodplain deposits and terraces adjacent to a large river (Figure 1). The facility is located in a temperate climatic setting, with average annual precipitation of approximately 40 to 42 inches. The plant produces a variety of inorganic and organic compounds. Chemicals produced at the site include the following:

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(A) The single RCRA regulated facility is a 12 foot deep lined impoundment, with areal dimensions of 80 feet by 190 feet. It sits on a level alluvial terrace remnant. The local topography slopes steeply both above and below the terrace. Liquid wastes consist of wastewater treatment sludge (K106) from the mercury cell process employed at the site. The mercury is precipitated as mercury sulfide in the impoundment, with the effluent treated with carbon filtration before being discharged to the adjacent river. The sludge layer is periodically dredged from the bottom and removed. A plastic liner is employed as the containment system. In 1978, a 6" layer of bentonite clay was placed on the old liner and a second 30 mil HP flex seal liner was installed over the clay.

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EXPLANATION



MAIN PRODUCTION FACILITY

FIGURE 1, Location of Plant Site and Mercury Pond

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- o 1,2-Dichloroethene
- o 1,1,2-Trichloroethane
- o Bromoform
- o Chloroform
- o Trichloroethene
- o Tetrachloroethene
- o Carbon Tetrachloride
- o Benzene
- o 1,4-Dichlorobenzene
- o 1,2-Dichlorobenzene

(B)

This is a non-sequitur

HYDROGEOLOGIC SETTING

Physiography and Soils

The plant site is situated on a series of alluvial and glacio-fluvial terraces which rise from a major river which is located about 700-800 yards to the west of the regulated facility. The plant lies at an elevation of about 620 feet near the river to 700 feet at the base of dissected highlands rising to the east of the site.

Soils at the site include fill materials (made land) and deep, well drained stony, yellowish brown to grayish brown, alluvial and colluvial deposits. Permeability values for these soils range from 5.6×10^{-4} cm/sec to 3.5×10^{-3} cm/sec. The alluvial deposits may attain thicknesses of 120 feet below the terraces.

Bedrock and Surficial Geology

Bedrock under the site consists of terrestrial and marine sedimentary strata of Paleozoic age. A near-complete geologic section of the Paleozoic era is represented at the site. Lithologies range from sandstones, siltstones, and mudstones to freshwater and marine limestones, and coals.

Seven boreholes were drilled near the impoundment by a geotechnical consultant during late 1980. Locations of the boreholes, as well as the geologic cross-sections are indicated in Figure 2. The geologic cross-sections are shown in Figures 3a and 3b. The cross sections indicate that the shallow sub-surface materials consist of a mixture of clay, silt, sand, gravel and rock fragments overlying mudstone, siltstone, or sandstone bedrock. Depth to bedrock ranges from 50 to 100 feet below the ground surface at the site. The sediments suggest a colluvial or alluvial origin.

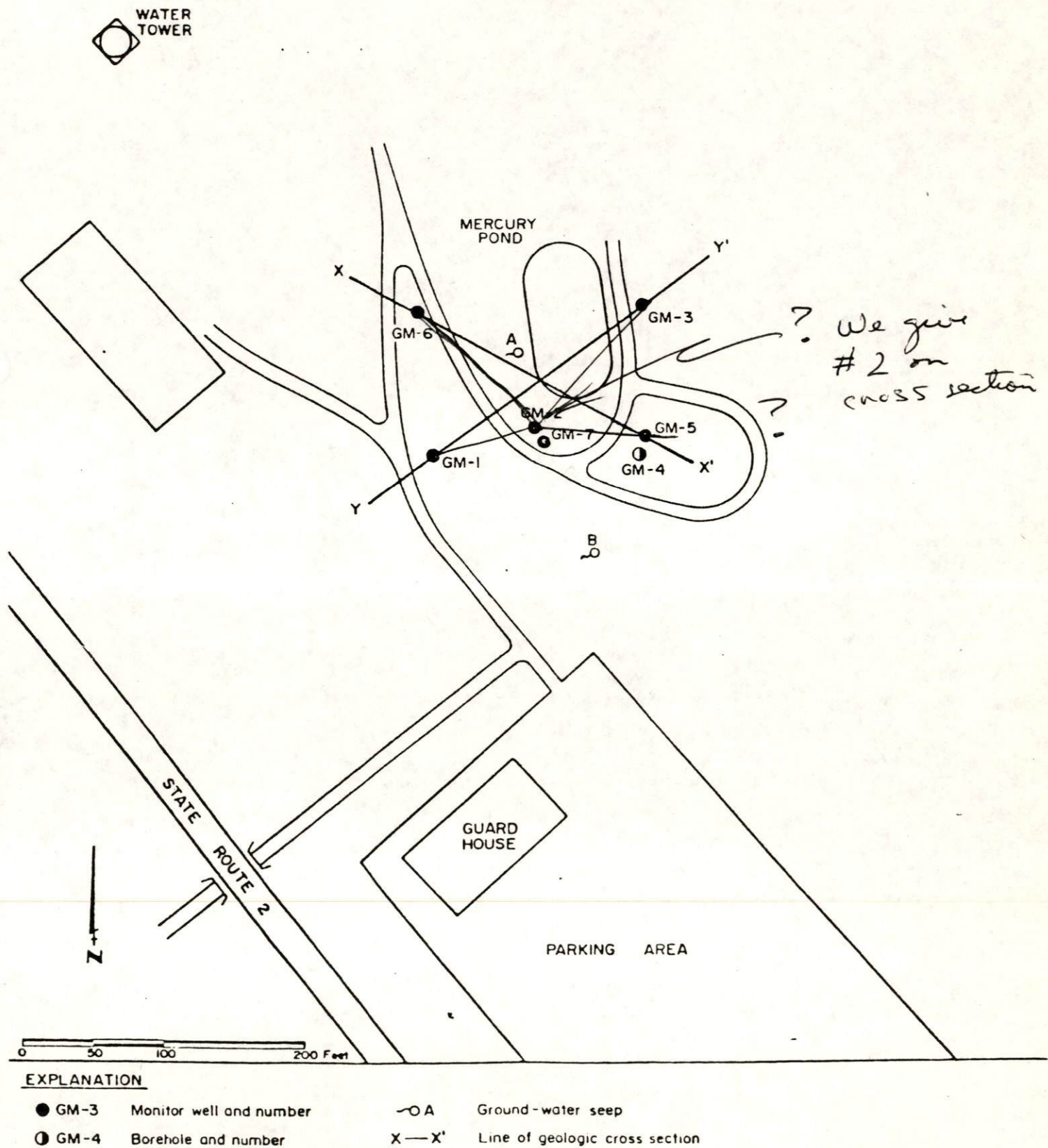
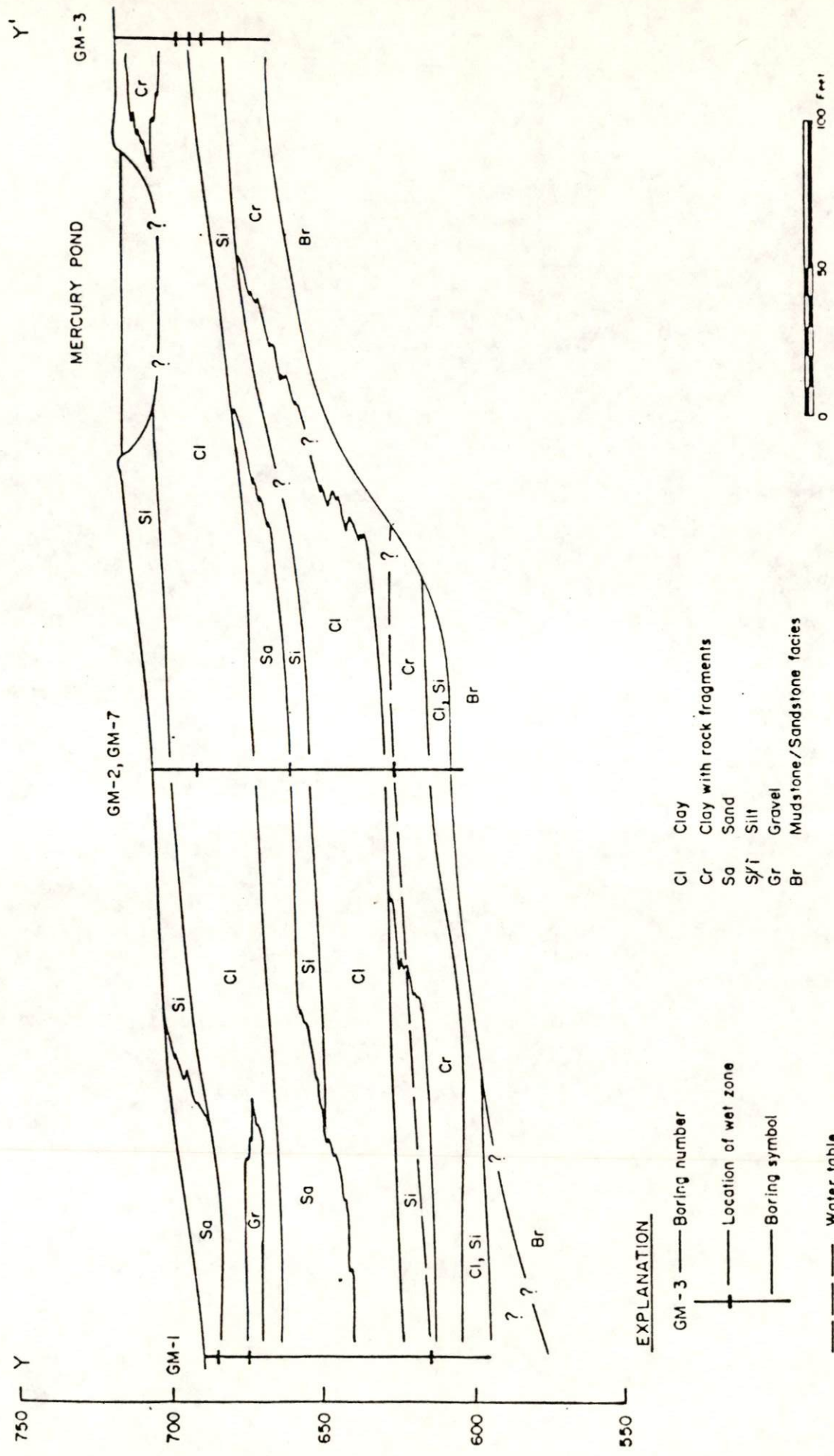


Figure 2. Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections



EXPLANATION

- GM - 3 — Boring number
- +— Location of wet zone
- Boring symbol
- Water table
- Cl Clay
- Cr Clay with rock fragments
- Sa Sand
- Si Silt
- Gr Gravel
- Br Mudstone/Sandstone facies

Figure 3a. Geologic Cross Section (Y-Y')

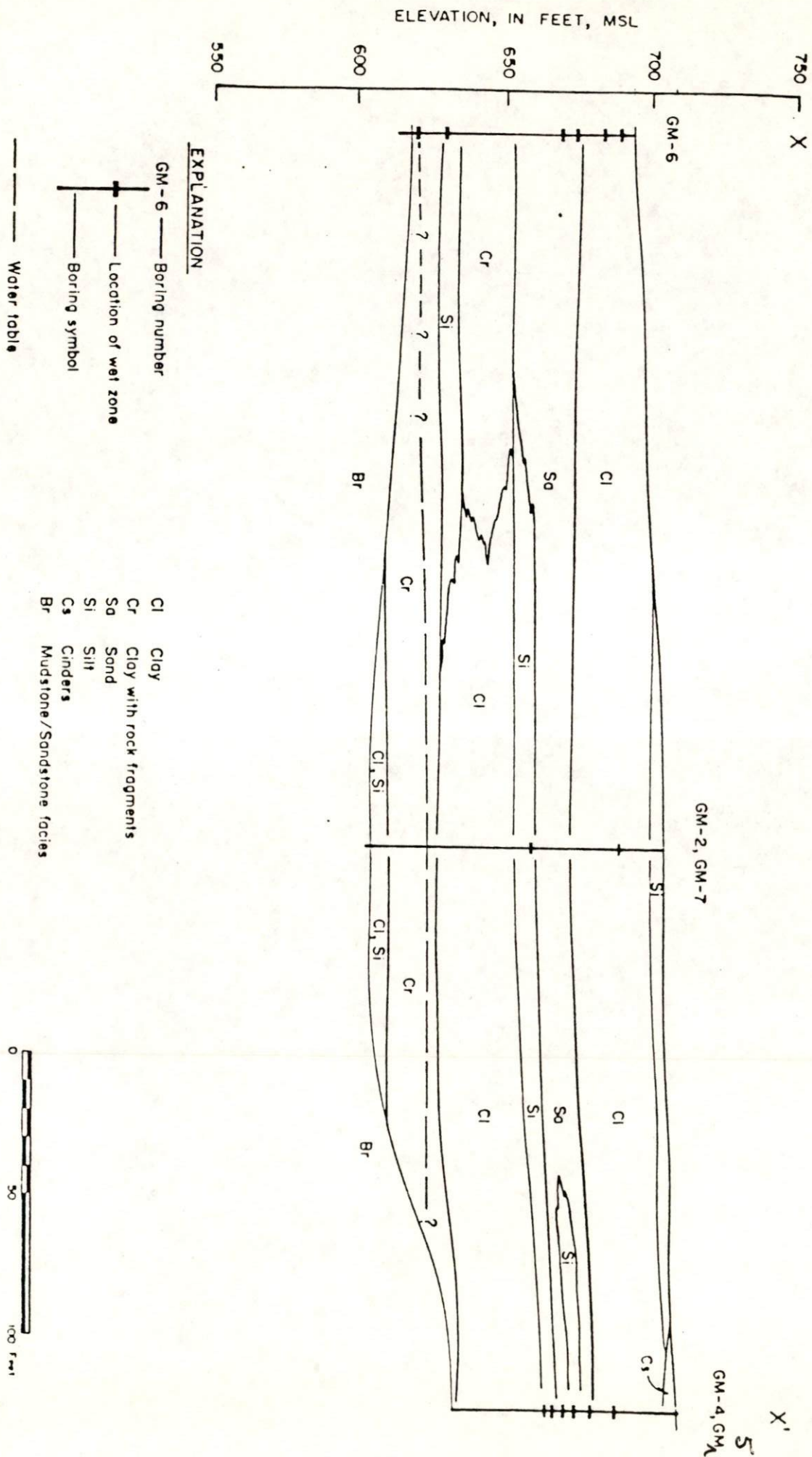


Figure 3b. Geologic Cross Section (X-X'),

At least two, more or less continuous, clay strata underlie the regulated unit. These units vary in thickness from 8 to 28 feet. Below the upper clay unit at depths of 20 to 30 feet below the surface, is a dry to occasionally moist brown sand layer, 10 to 15 feet in thickness. This, in turn, is underlain by a moist to wet, 4 to 12 foot thick silt layer, a thick clay unit up to 25 feet in thickness, and finally a basal silt unit above the bedrock contact. Vertical permeability values for clay and silt units below the impoundment were determined from Shelby tube samples in the laboratory (Table 2) and suggest fairly low groundwater velocities. However, in-situ horizontal permeabilities and those associated with coarser-grained sediments would be expected to be several orders of magnitude higher.

Surface and Subsurface Hydrology

Intermittent streams drain surface water from the site toward the major river to the west. The streams by-pass the impoundment area. Surface seeps, as indicated in Figure 2, crop out along the side of the terrace upon which the impoundment sits. This represents the perched water table which underlies the impoundment and shows evidence of contamination. The perched condition is evidently not continuous, but is encountered in silt and sand lenses at depths of up to 30 feet below the surface. The moisture content of this layer varies seasonably, becoming saturated in the spring and early summer. Water table elevations in the perched horizon (Figure 4) suggest flow to the west and southwest.

A more productive semi-confined aquifer, located approximately 50 feet below the perched water table is associated with alluvial silt and fine sand deposits above the bedrock contact. The potentiometric surface of this aquifer (Figure 5) again suggests a predominant westward flow towards the major river.

(C) Production wells at the site tap this aquifer for cooling and process water. They are located 1000 to 2000 feet west of the site and are pumped at a combined discharge of approximately 5 mgd. The pumping stresses result in a composite cone of depression some 10 to 15 feet below the normal river stage. Water levels in the monitoring wells located at the site are also affected by the pumping. Water levels are reduced by 2 to 30 feet below ambient levels.

TABLE 2. VERTICAL HYDRAULIC CONDUCTIVITIES OF SHELBY TUBE SAMPLES

Well Number	Depth Interval (ft)	Hydraulic Conductivity		Sample Description
		(cm/sec)	(ft/day)	
*GM-2	11-13	3.0×10^{-8}	8.5×10^{-5}	Clay, tight, plastic, brown and orange-tan, with weathered rock fragments, micaceous
GM-3	27-29	1.5×10^{-6}	4.2×10^{-3}	Silt, clayey, gray- green with brown mottles, wet

*sieve analyses also available for this sample

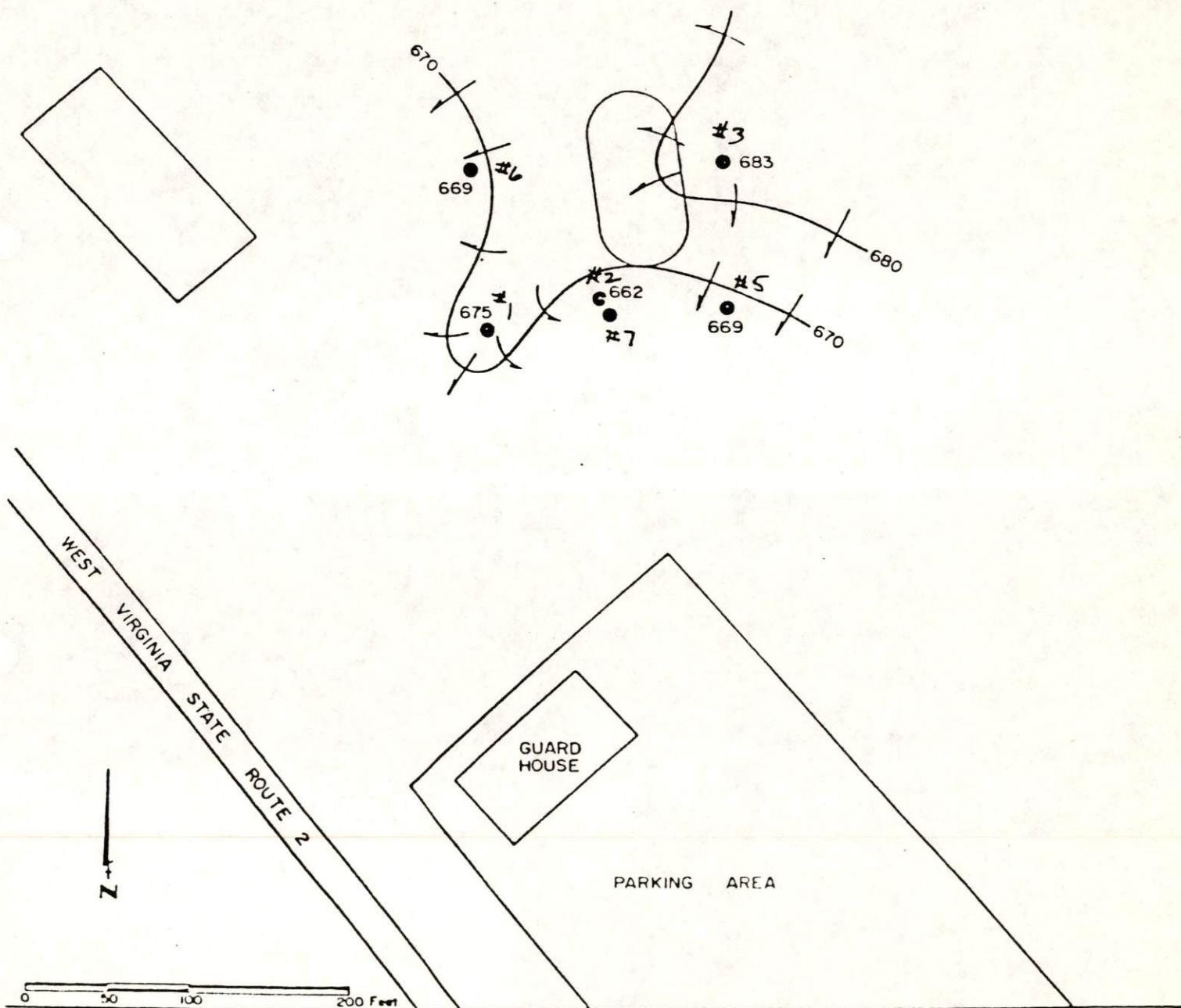


Figure 4. Elevation of the Bottom of the Perched-Water Zone

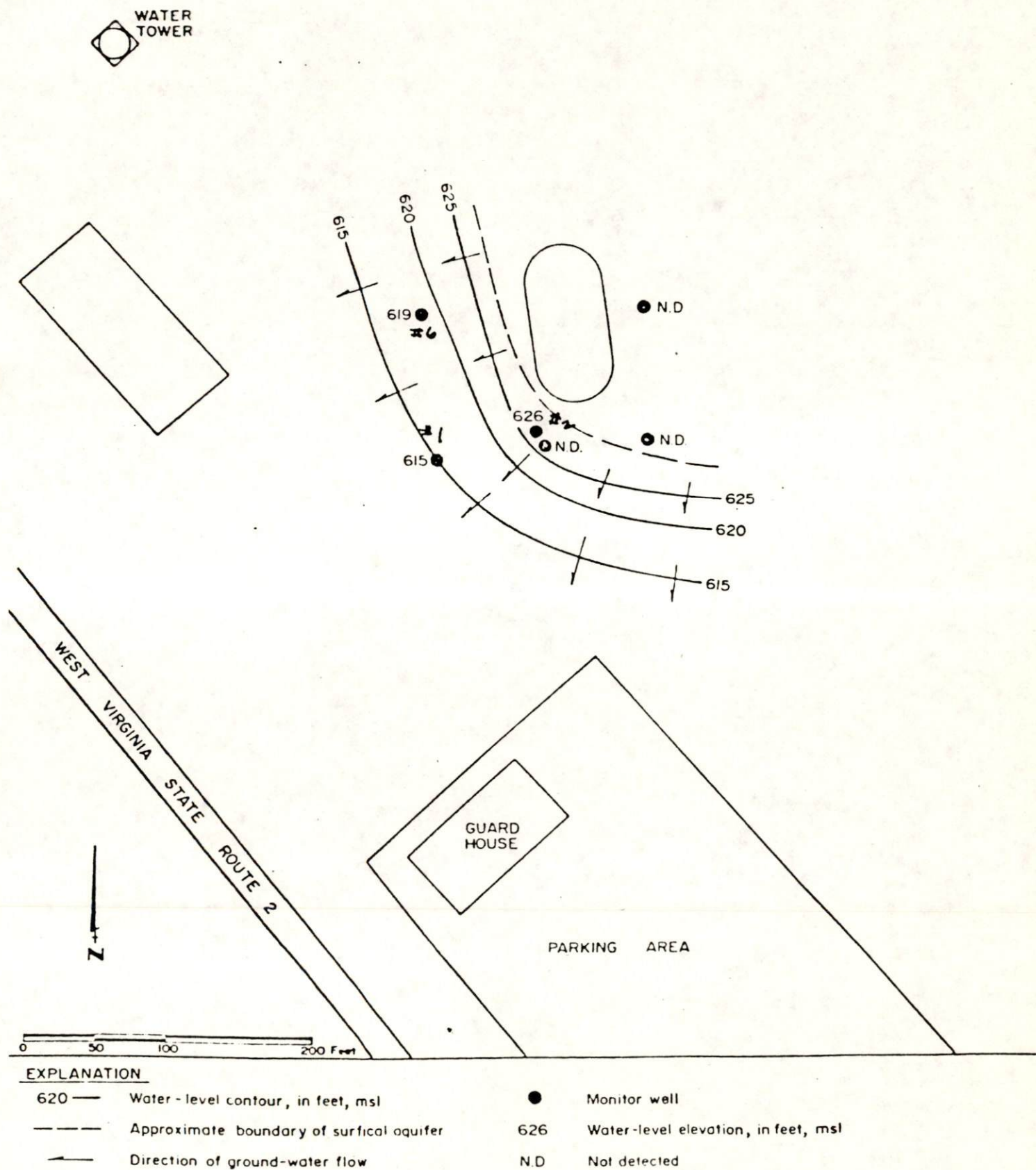


Figure 5. Water-level Contour Map of the River Alluvial Aquife

Monitoring Well Network

Six monitoring wells were constructed in the latter part of 1980, using hollow stem auger techniques and a CME B-61 rig. Split spoon samples were taken at 5 foot intervals. Auger flights were washed between boreholes to avoid cross-contamination problems. This constitutes good drilling practice. Undisturbed Shelby tube samples that were taken in two boreholes were collected for laboratory analysis of hydraulic conductivity, as summarized in Table 2. Apparently, only the finer grained horizons were tested for this parameter. It would have been instructive to also evaluate the sand and silt layers, in order to evaluate the potential for lateral migration of constituents below the impoundment. Three wells (GM-1, GM-2, and GM-3) monitor the deep alluvial aquifer, while the remainder monitor the shallow-perched groundwater horizon (Figure 6). Borehole GM-4 was not completed as a monitoring well. The wells in the alluvial aquifer comprise the three downgradient wells in the RCRA network. As discussed in a later section, a plant production well is currently being used as the "upgradient" well in the RCRA network.

Monitoring well logs are included in Appendix A, and details of the monitoring well construction are shown in Figure 7. Well construction consisted of 2" PVC casing and 0.008 inch slot PVC screen. The annulus was sealed with a gravel pack to at least 5 feet above the screened interval, a 1 foot bentonite layer above the gravel pack, a Portland cement grout layer, a layer of cuttings, and a second capping layer of cement grout. A 4" steel casing with a cap was cemented around the PVC casing to prevent precipitation and runoff from entering the monitoring well. The monitoring wells were apparently developed after installation. Although the PVC materials are probably acceptable for inorganic parameters, their use for organics is questionable; this because of the potential for adsorption/desorption of organic constituents in such materials. Several other concerns regarding the details of the monitoring well network can be cited, as discussed in the following section.

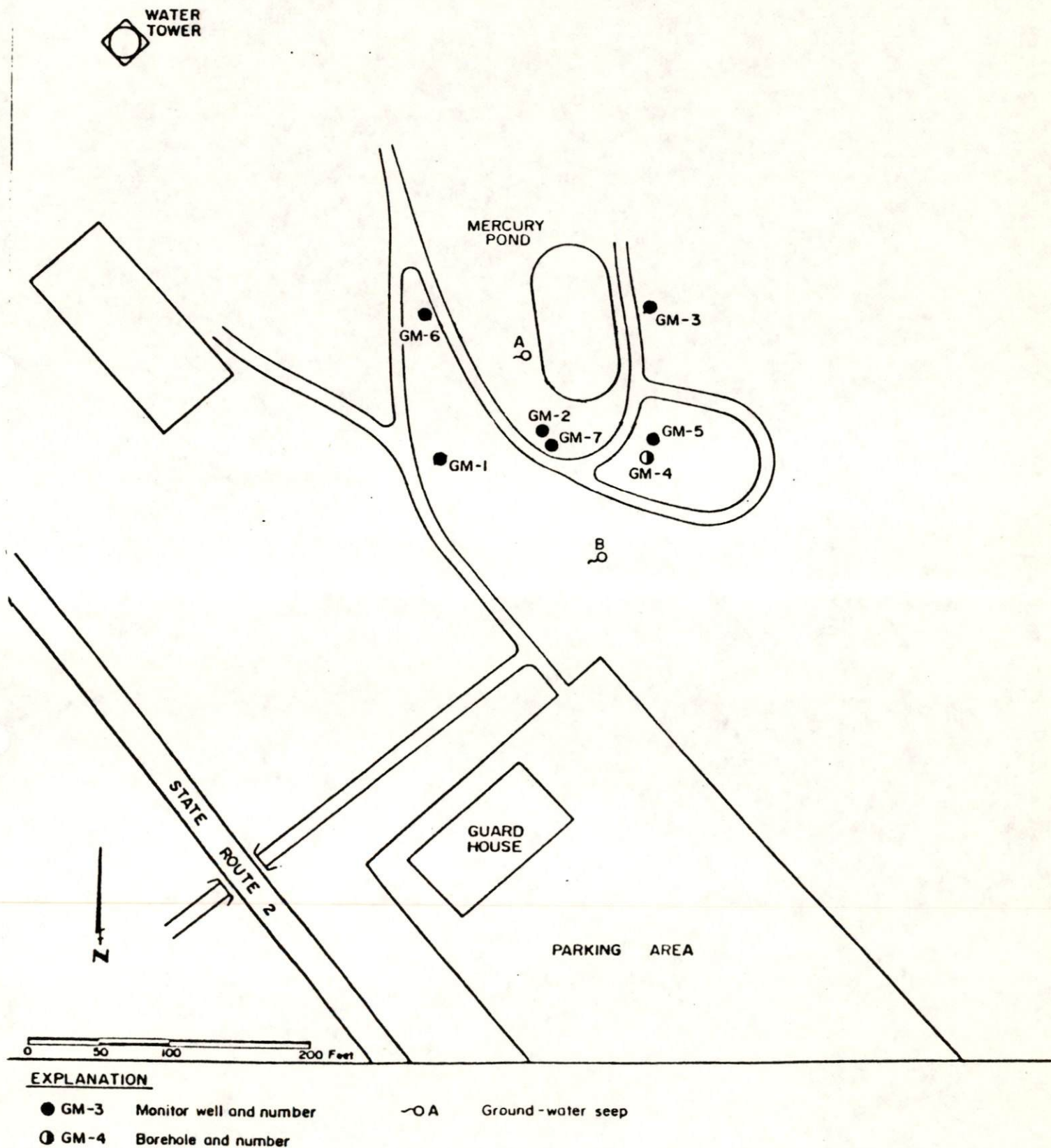
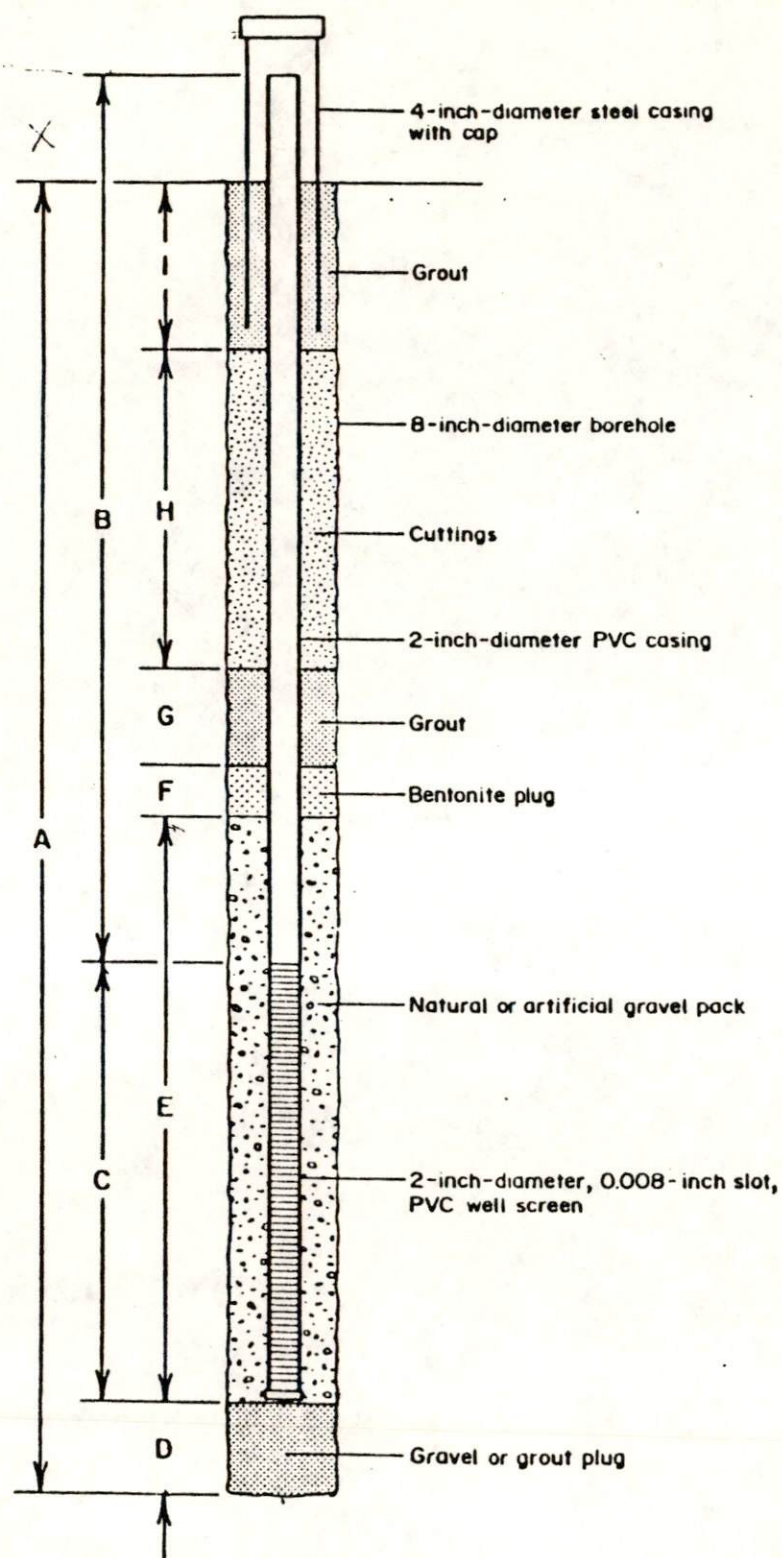


Figure 6. Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.



	WELL NUMBER					
	GM-1	GM-2	GM-3	GM-5	GM-6	GM-7
A	96	99.75	54.75	45	81	54
B	89	92	23.25	37.3	67.9	47.3
C	10	10	10	10	10	10
D	0.6	1.0	24.75	1.0	6.2	0
E	32.4	31.25	15	14.25	21.8	27
F	1	1	1	1	1	1
G	10	16.5	5	9.75	12.5	9
H	48	47	7	16.5	37.5	15
I	4	3	2	2.5	2	2

Figure 7. Monitor-Well Construction Diagram.

Deficiencies in Monitoring Well Network

Several concerns have been identified by both the state regulatory agency and the EPA regional office, with regard to the adequacy of the monitoring well network. A "Compliance Evaluation Inspection" completed by the state regulatory agency in November 1983, following an on-site inspection, cited several deficiencies, and served a notification of violation of state regulations. ✓

Firstly, as Figure 3a indicates, the bedrock surface rises quickly to the east under the impoundment. This results in a pinch-out of the sand and silt layer, comprising the first aquifer beneath the site. Consequently, the water table lies below the bedrock surface in this part of the site. The facility, after drilling well GM-3, apparently abandoned further efforts to locate another well that would be upgradient from the impoundment and still would tap into the first aquifer. Instead, they designated a drinking water production well (GM-0), located 2000 feet northwest of the impoundment, to represent background groundwater conditions. As cited in the compliance report, this selection is questionable in several respects.

The well is pumped at a fairly high discharge (100-125 gpm) and so dilution of formation waters is certainly occurring. A second process water well is located downgradient from GM-0; the former is pumped at a rate of 600 gpm. The combined effects of the two wells is to produce a cone of depression, which at its deepest point is lower than the stage of the adjacent river to the west. Normally, the water table would slope upward away from the river, and so it is apparent that the pumping wells have considerable effect on the local groundwater setting. According to the compliance report, the two production wells may have the capacity to draw contaminants from other parts of the site to the "up-gradient well". As a result the placement of GM-0 does not appear to fulfill the requirements of 40 CFR 265.91(a)(1), 265.91(a)(1)(i), nor 265.91(a)(1)(ii). Furthermore, the well head is sealed, and the well is continuously pumped, making determination of water table elevations as required by 40 CFR 268.92(e), difficult. No information regarding the well construction materials and details is available. It is thus unclear whether downgradient wells and GM-0 are of similar design. This results in difficulty of evaluating sampling data from the two sets of wells. For example, if GM-0 is constructed of large diameter steel casing (as most production wells are) then the potential for adsorption/desorption of water quality constituents will differ from the wells with PVC casing. ✓
⑤

The facility ~~probably~~ should have conducted more preliminary borings to try to locate a more appropriate location for the upgradient well. Alternatively, the GM-3 well could be deepened to intersect the water table in the shallowest permeable horizon of the bedrock. Though this would place the upgradient and downgradient wells in different stratigraphic horizons, this configuration would be preferable to the present one. ✓

2) A second issue cited in the compliance report concerns the location and depths of the downgradient wells. As indicated in Figures 4 and 5, groundwater flow directions are predominantly due west, in both the perched and alluvial aquifers. However, the placement of wells GM-1, GM-2, and GM-6 are such that no well monitors the central portion of the impoundment. Furthermore, only the bottom 10 feet of each well is screened. This, in combination with the close proximity of the wells to the impoundments (30-70 feet) and the presence of a 8-28 foot thick clay layer underneath the impoundment, would "severely limit the capability of these wells to intercept a contaminant plume...The low permeability layer...could be expected to prevent downward migration of contamination...until it is beyond the monitoring wells...[and] render the present wells ineffective in detecting the presence of hazardous constituents which migrate from the regulated unit". Thus it appears that the facility may be in violation of 40 CFR 265.91(a)(2).

Other wells at the site do tap the perched layer, which as has been mentioned previously, does exhibit existing contamination. They are not sampled within the RCRA program, however, due to dry conditions during the summer. They could be sampled during the spring, and perhaps should be included in the monitoring network.

Results of sampling conducted by the state, as part of their compliance inspection, are listed in Table 3. Barium levels exceed EPA SDWA standards in well GM-1, while all three wells that were sampled exhibit detectable organic levels.

~~The deficiencies of the monitoring well network were also cited in a complaint and consent order against the facility, filed by the EPA regional office in March 1984. The region proposed a fine of \$15,000 for failure to install an adequate groundwater monitoring system, and instructed the facility to submit plans for installation of alternative upgradient and downgradient wells.~~

TABLE 3.

Samples collected on August 3, 1983

Chemical Analyses

(Analyses in mg/l unless otherwise stated)

Parameter	<u>Sampling Point</u>		
	GM-0	GM-1	GM-6
TOC	2	12	N.T.F.
Chloride	27	27	N.T.F.
Sulfate	121	1	N.T.F.
*Phenolics	1	4	N.T.F.
*Arsenic	<2	20	3
Lead	< .01	.03	.04
Barium	.06	1.2	.24
Cadmium	.001	.002	.003
*Mercury	< .1	.23	< .1

*Analyses in µg/l

N.T.F. = Not Tested For

(Analyses in µg/l)

Parameter	<u>Sampling Point</u>			
	Field Blank	GM-0	GM-1	GM-6
Methylene Chloride	N.D.	1.78	10	11.1
1,2-Dichloroethene	N.D.	N.D.	25.4	53.4
1,1,1-Trichloroethane	N.D.	N.D.	.688	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	11.0	24.5
Bromoform	N.D.	N.D.	3.40	5.91
Tetrachloroethene	N.D.	51.0	28.9	26.0
Chloroform	N.D.	N.D.	.916	1.60
Carbon Tetrachloride	N.D.	N.D.	1.27	2.12
Trichloroethene	N.D.	7.91	10.7	24.2
Benzene	N.D.	N.D.	4.10	7.0
1,4 Dichlorobenzene	N.D.	N.D.	5.0	8.0
1,2-Dichlorobenzene	N.D.	N.D.	10.1	15.7
Volatiles	N.D.	N.D.	N.D.	N.D.
Aromatics	N.D.	N.D.	N.D.	N.D.

N.D. = None Detected

SAMPLING AND ANALYSIS

Sampling and Analysis Plan

(5) A copy of the facility's Sampling and Analysis Plan is included in Appendix B. This plan outlines the frequency of sampling, sampling parameters, required equipment, collection measures, sample preservation, analytic techniques, and chain of custody procedures. Sample preservation and analytical techniques are fairly well documented. Sampling collection procedures and chain of custody descriptions are rather brief. Furthermore, evacuation and sampling procedures as described in the plan appear to differ from those actually employed in the field. Where methods have changed in the sampling protocol, the plan should be updated.

Whole bladder
7? If silicon
rubber bag
Well evacuation prior to sampling is accomplished by a Tole submersible bladder pump. The device incorporates a nitrogen driven squeeze pump. No contact between the sample water and the gas takes place. The pump has a stainless steel body, tygon check valves and tygon tubing and return lines. Again the tygon tubing is probably appropriate for inorganic analytes, but ~~may not be for organic constituents~~ ^{is not for} due to the ~~potential for~~ adsorption/desorption processes. The operation of the pump also results in considerable turbulence, as noted by EPA staff during a recent on-site inspection. This would result in loss of volatiles and bias organic constituent analyses. The bladder pump is rinsed three times with distilled water between each well evacuation. (According to the EPA observer, this may not be adequate to prevent cross-contamination problems.) (3)

(14) The wells are pumped dry and then allowed to recover before sampling. This takes anywhere between 2 to 5 days. The intake tube is consistently positioned 1 foot above the bottom of the well. Evacuated water is discharged to the ground, down-slope from the well casing. Nonetheless, the discharge of potentially contaminated water to the ground is poor practice. no tube, pump

The same pump is used to collect water quality samples. The samples are taken 1 foot from the bottom of the well. Inorganic samples are filtered in the field and treated with preservatives in the laboratory. Phenol and TOC samples are fixed in the field. Sampling bottles are washed with detergent, then rinsed

check
this
Their
lab is
100 yd
away.

(E) with hydrochloric acid, nitric acid, and finally distilled water, prior to sample collection. Sample caps are screw-type teflon lined, while septums are 2.5 mw Tuffbond, manufactured by Pierce Co. Blanks are used in the laboratory for calibration of inorganic samples. No field blanks are employed.

double check
The facility has apparently not changed sampling methods, testing methods, nor testing laboratories since the initiation of groundwater monitoring.

Groundwater Assessment

In October, 1983, the facility notified the EPA regional office of statistically significant increases over background for TOC and specific conductivity. In fact, starting with the first quarter of sampling, at least one constituent was found to exceed EPA Interim Primary Drinking Water Standards (Appendix C and Table 4) during each round of sampling in each of the downgradient wells.

Table 4

Well	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
GM-0	No Parameters Exceeded Standards			
GM-1	Barium Radium Gross Alpha Gross Beta Coliform Bacteria	Barium Cadmium Coliform Bacteria	Arsenic Cadmium Lead	Arsenic Barium Coliform Bacteria
GM-2	Cadmium Gross Beta Coliform Bacteria	Cadmium Coliform Bacteria	Cadmium Coliform Bacteria	
GM-6	Cadmium Radium Gross Alpha Gross Beta Coliform Bacteria	Coliform Bacteria	Coliform Bacteria	Lead

The facility claimed that the differences in downgradient and reference samples were the result of "natural variations in fluid chemistry resulting from litho-

This implies a change in facility rather than a change in what it holds — which is correct.

logic differences in aquifer materials and/or remnants of seepage from a brine storage facility that occupied this site about twenty years prior to the installation of the mercury surface impoundment." The facility embarked on groundwater assessment program to determine the likely sources of specific conductivity and TOC. The proposed Water Quality Assessment Program (as described in Appendix D) essentially involves collecting a set of replicate samples from the impoundment and the downgradient wells, analysis of the samples for selected water quality parameters, comparison of constituent ratios (e.g. Na/Cl ratios) for the impoundment and well samples, notification of the regional EPA office following the completion of the analysis, and preparation of a report documenting the results of the program. An implementation schedule is also included with the assessment outline, with a start-up date preceding the date of the notification letter and a completion date two months later.

The assessment outline is rather vague about the proposed steps, given a determination that the impoundment does represent a likely source for the elevated TOC and specific conductivity levels. The outline mentions possible additional sampling and analyses of groundwater and surface impoundment fluids. As part of the previously mentioned complaint and consent order issued by the regional EPA office, the facility was cited for violations of 40 CFR 265.93(d)(2) and ~~265.93(d)(2) and~~ 265.93(d)(3). The violations resulted from insufficient detail of sampling and analysis procedures in the proposed assessment, and failure to have the plan certified by a qualified geologist or geotechnical engineer. Furthermore, the plan did not address the issues of rate and extent of migration of the waste constituents, as required by 40 CFR 265.93 (d)(4)(i). a

(F) The facility's consultant conducted the Groundwater Quality Assessment Program during the fall of 1983 and submitted their findings in December, 1983. Results of the two rounds of sampling collected during the study are shown in Table 5.

(G) Three general conclusions were drawn from the study by the hydrogeologic consultant: (1) the elevated TOC and specific conductivity levels did not result from leakage of the present mercury impoundment, (2) statistically higher TOC values in the downgradient wells (relative to background) result from a greater proportion of natural organic sources in the downgradient well area, and (3) statistically higher specific conductivity levels in the downgradient wells

TABLE 5.
RESULTS OF CHEMICAL ANALYSES CONDUCTED DURING THE WATER-QUALITY ASSESSMENT PROGRAM
AT THE MERCURY POND FACILITY
(all values expressed in mg/l unless otherwise specified)

Well location	pH (std. units)	SC (unhos/cm)	TOC	TDS	Total ALK. (as CaCO ₃)	HCO ₃ ⁻	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	SiO ₂	Hg (ug/l)	Na/Cl
<u>10/19/83 Sample Set</u>																	
GM-0	6.9	678	1.2	425	212	259	19	84	-	-	-	-	-	-	-	-	-
GM-1	7.1	1158	9.0	650	602	73	18	<10	122	1.4	100	29	0.1	1.0	11.5	<0.5	6.8
GM-2	7.0	1355	5.7	758	596	727	79	<10	172	3.0	99	23	0.9	1.7	13.4	<0.5	2.2
GM-6	7.3	1050	7.4	635	207	253	61	188	97	2.7	98	16	<0.1	0.7	8.5	<0.5	1.6
Hg Pond	11.6	91625	4.0	85950	1424	1737	49000	1640	35200	19.4	13	<1	<0.1	<0.02	31.4	347	0.72
<u>10/27/83 Sample Set</u>																	
GM-0	7.1	719	1.4	485	202	246	27	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1178	8.1	675	599	731	49	<10	123	1.5	103	28	10.7	1.1	11.8	0.5	2.5
GM-2	7.0	1369	3.1	743	579	706	84	<10	203	3.2	92	21	5.1	1.5	13.8	<0.5	2.4
GM-6	7.2	1055	5.5	610	202	248	69	177	X	X	X	X	X	X	X	X	X
Hg Pond	12.0	61500	3.9	52400	5854	7142	29000	840	22000	17.4	16	0.1	.1	<0.02	19.3	350	0.76
<u>Mean Average of 10/19/83 and 10/27/83 Data</u>																	
GM-0	7.0	699	1.3	455	207	253	23	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1168	8.6	663	601	733	34	<10	123	1.5	102	29	5.4	1.1	11.7	<0.5	3.6
GM-2	7.0	1362	4.4	751	588	717	82	<10	188	3.1	96	22	3.0	1.6	13.6	<0.5	2.3
GM-6	7.3	1053	6.5	623	205	250	65	183	97*	2.7*	98*	16*	<0.1*	0.7*	8.5*	<0.5*	1.6*
Hg Pond	11.8	76563	4.0	69175	3639	4441	39000	1240	28600	19.4	15	<1	<0.1	<0.02	25.4	349	0.73

- Not analyzed

X Insufficient sample volume for analyses

* Value based entirely on 10/19/83 data

represent residual contamination from the previous concrete lined brine storage pond.

As before is this a new "impoundment"

Source

The rationale for the contention that naturally occurring organics are the source of observed TOC values, is based on comparison of TOC levels in the monitoring wells with "natural TOC levels [which] typically range from <5 to 10 or more . . . mg/l." TOC levels ranged from 3.1 to 9.0 mg/l in the downgradient wells during the assessment sampling, although values 2-3 times have been recorded in MG-1 during the past quarterly sampling runs. The facility's consultant also suggests that the finer-grained sediments, in which the downgradient wells are set, contain a higher proportion of organic matter (e.g. coal fragments) than the sand and gravel alluvial deposits of the GM-0 well. Unfortunately, the facility has not submitted a lithological log for the GM-0 well, and so it is difficult to evaluate this point. Another problem is that since all the downgradient wells are downgradient from the impoundment, it is difficult to separate the effects of the influence of natural organics and possible leakage from the present or previous impoundments. One way to test whether the two sets of lithologies do have different ambient TOC levels, would be to perform additional borings and water quality sampling upgradient from the impoundment site (or far enough away from the impoundment to insure against possible contamination from the preexisting or existing impoundments).

And if Howards, the impoundment, they did single it, how?

Another possible explanation for the difference between downgradient and reference well TOC levels is possible dilution of constituents in the production well. This possibility is not discussed in the assessment report.

The report also states that the facility "has not stored or disposed of synthetic organic compounds in the [impoundment area], (as evidenced by low TOX values)". Yet the results of the most recent split sampling do show detectible levels of TOX in the monitoring wells. [Furthermore, the regional EPA office is apparently unconvinced about the presumed absence of organics, in that they have proposed the inclusion of several organic constituents in the facility's monitoring program, as part of the previously mentioned consent order.]

The assessment report also discusses the problem of observed elevated downgradient specific conductivity levels. Reference to Table 6 which contains results

TABLE 6.
 AVERAGED RESULTS OF WATER-QUALITY ANALYSES CONDUCTED DURING 1982 DETECTION MONITORING
 AT THE MERCURY POND FACILITY
 (averages represent mean of 1/4/82, 5/10/82, 8/3/82, and 11/15/82 water-quality data;
 all values are expressed in mg/l unless otherwise specified)

Well Number	pH (Std. units)	SC (micro/cm)	TOC	TOX (ug/l)	TDS	Total ALK. (as CaCO ₃)	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	lib (ug/l)	Na/Cl
GN-0	7.1	618	3	49	399	287	350	21*	80	11	2	108	11	0.1	<0.01	<0.2	0.5
GN-1	7.2	995	17	77	619	506	617	25	4	136	2	116	32	29	1.5	<0.5	5.4
GN-2	7.1	1249	7	48	779	504	615	69	9	245	5	107	25	11	2.7	<0.5	3.6
GN-6	7.2	896	10	26	585	259	317	68	123	130	5	103	15	6	2.1	0.4	1.9

* Median value used because of anomalously high result in 1/4/82 analysis.

of detection monitoring data for 1982, suggests that the higher specific conductivity levels in the downgradient wells result from relatively higher concentrations of total dissolved solids, chloride, sodium, magnesia, and iron. Tables 5 and 6 also indicate, according to the assessment report, that downgradient well and impoundment fluids have "vastly different" chemical characteristics, namely:

- o downgradient wells show near neutral pH values, while impoundment fluids show very high pH levels (11.6 to 12.0),
- o dissolved mercury is negligible in downgradient wells, whereas it is present in concentrations of about 350 ug/l in the impoundment, and
- o downgradient wells show relatively high Na/Cl ratios (1.6 to 6.8), in contrast to the impoundment with ratios ranging from .72 to .76.

The latter point suggests, as mentioned by the consultant, that the impoundment is not the source of the elevated constituents in the downgradient wells, nor is the residual contamination from the pre-existing brine pond! Yet considerable visual evidence and other statements made by the facility, indicate that the brine pond did, in fact, leak and is responsible for much of the existing inorganic contamination at the site. The consultant then goes on to explain how an initially low Na/Cl ratio (from the leaking brine pond fluid) could be changed over time to reflect the currently observed ratios, for example differential sorption or desorption of sodium and chloride from clay-rich sediments. It would appear that these mechanisms could also affect the Na/Cl ratios of fluids that might be leaking from the present impoundment, as well. In short, the Na/Cl data is equivocal. Further analysis should be conducted to determine the period of flushing required to remove all of the pre-existing contamination. This could be done by estimating the mass of constituents released from the concrete-lined impoundment over its active life (e.g. based on a Darcian flow law) and the observed groundwater flux rates in the shallow aquifer system. This will give at least a rough indication of how much residual brine contamination remains at the site. Column tests could be run in the laboratory to determine whether adsorption/desorption processes could effect subsurface changes in Na/Cl ratios of the existing impoundment fluids. In the absence of more definitive data, and the continuing problem of an inadequate number and questionable location of the monitoring wells, the assessment appears to be of limited value.

Split Sampling Results

(7) Results of the split sampling conducted during the site visit are presented in Appendix E. A comparison of the results from the facility and EPA laboratories show minor differences for inorganic constituents, with the exception of well GM-7. Whereas a higher total dissolved solids level was found in the EPA sample, consistently lower metal concentrations were observed, relative to the facility samples. The metal concentrations for GM-7 were below the level of detection. This contrasts not only with the corresponding facility data, but also the EPA data for the other monitoring wells. This may suggest some problems with the GM-7 sample run in the EPA laboratory.

(8) Organic results showed a few differences between the facility and EPA data, as well. Higher TOC levels were observed in the facility data for well GM-0, GM-1, and GM-2. In only one well (GM-0) were organic constituents detected in measurable quantities as indicated by the facility data. Two compounds, C_2HCl_3 (trichloroethene) and C_2Cl_4 (tetrachloroethene), were found in this well. Comparable concentrations of these constituents were also found in the EPA sample. Four additional compounds were found in the EPA sample from this well:

- o Acrylonitrile
- o Trichloroethane
- o Acetone
- o Butanone

Four of the five remaining wells (EPA data) show only two organic constituents: methylene chloride and acetone; only acetone is found in the fifth well. It is not known why the suite of organics differs between the two sets of laboratory results, nor why the GM-0 well (supposedly the "upgradient" well) shows higher organic levels than the remaining wells in the EPA data. One possible explanation for the latter is the difference between construction materials; the monitoring wells were designed with PVC casing and screens, while GM-0 (which is a production well) is probably constructed of more durable materials, perhaps steel or cast iron. The fact that the GM-0 is continually pumped, and hence subject to contamination by lubricants, may also explain the presence of a different suite of organics than the other wells.

Lubricants would not be (1) chlorinated and (2) typical degreasers i.e. The pumps won't be lubricated if they have degreasers in them.

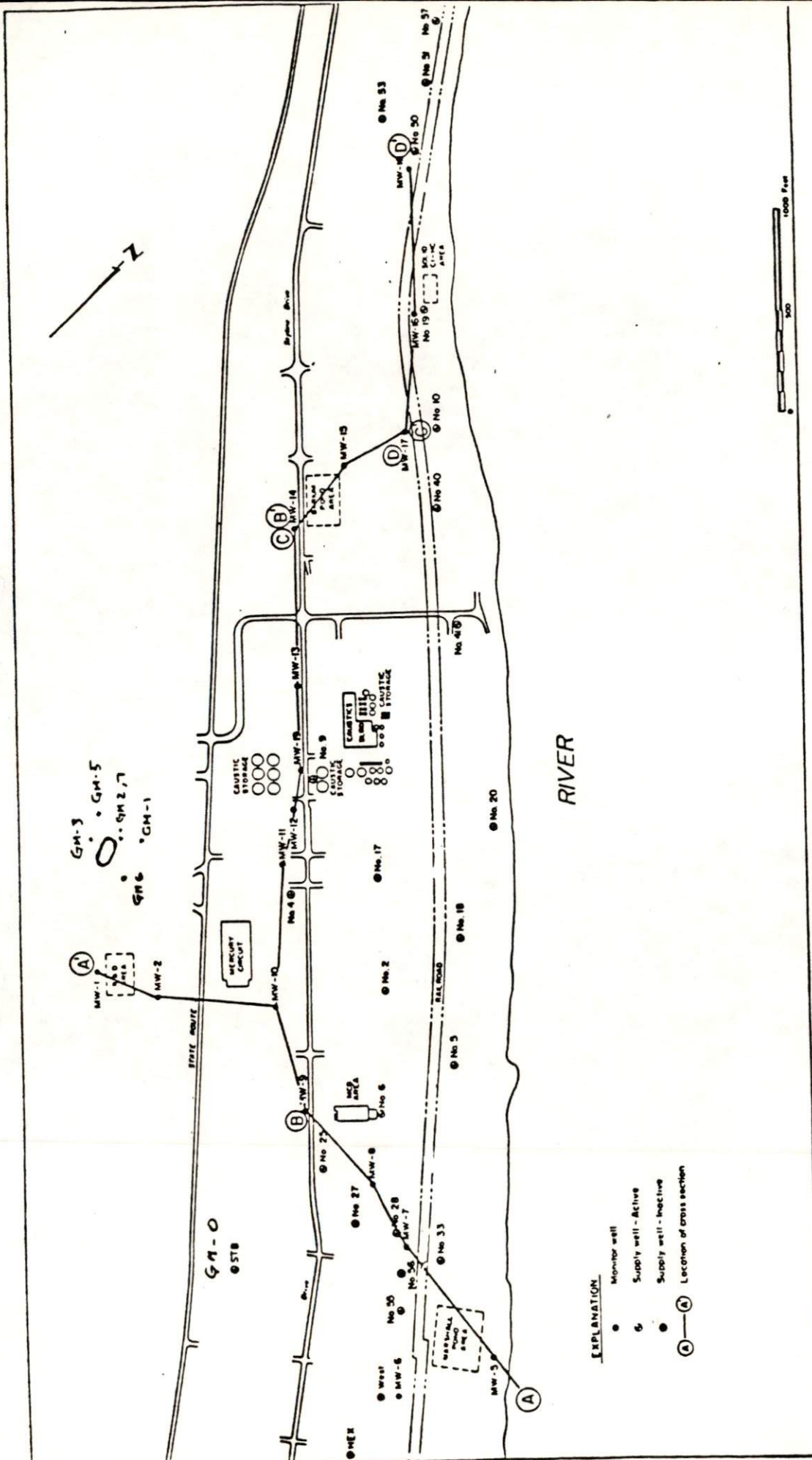
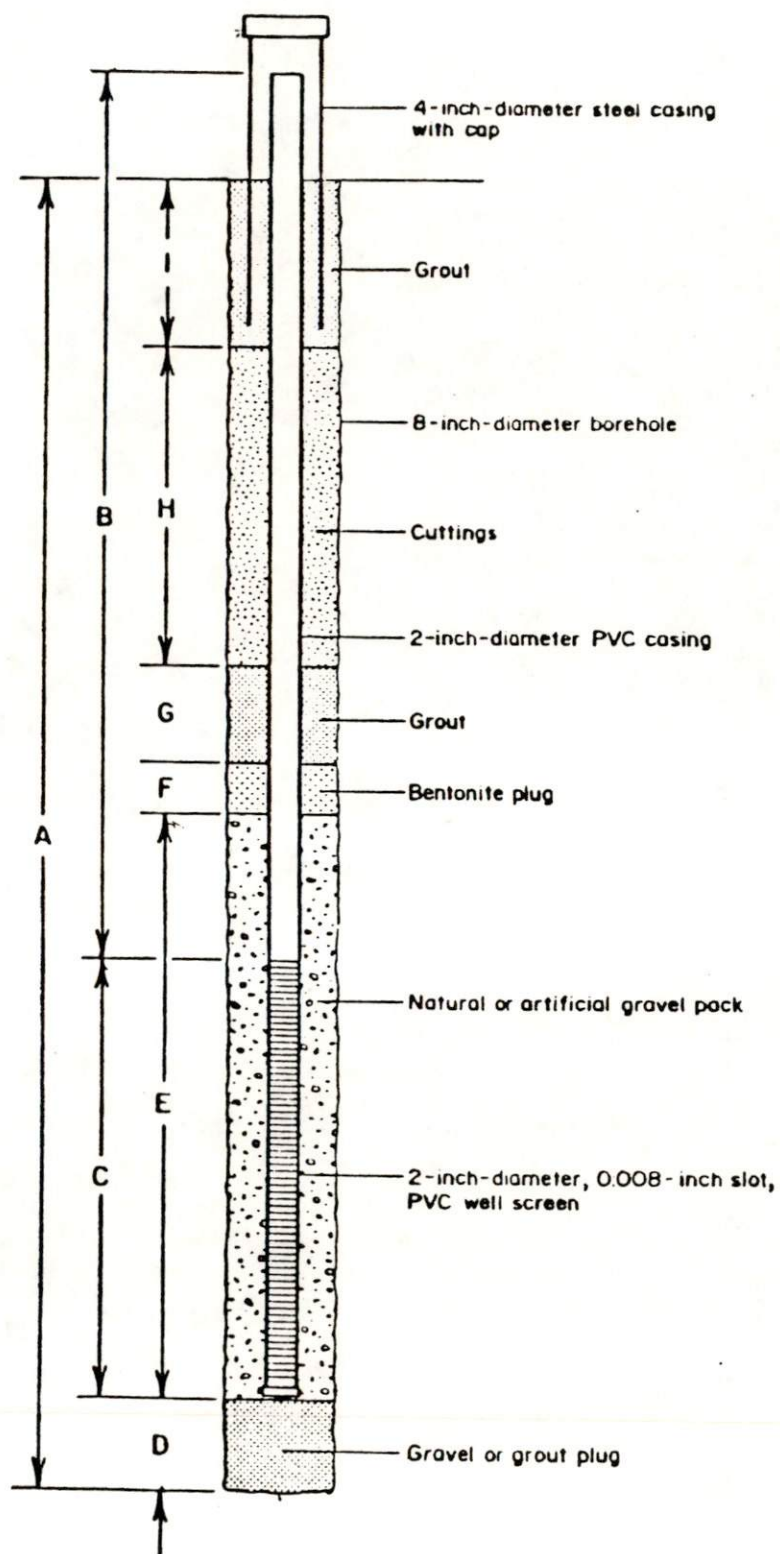


Figure 7. Location of GM-0 Well



DIMENSION, IN FEET	WELL NUMBER					
	GM-1	GM-2	GM-3	GM-5	GM-6	GM-7
A	96	99.75	54.75	45	81	54
B	89	92	23.25	37.3	67.9	47.3
C	10	10	10	10	10	10
D	0.6	1.0	24.75	1.0	6.2	0
E	32.4	31.25	15	14.25	21.8	27
F	1	1	1	1	1	1
G	10	16.5	5	9.75	12.5	9
H	48	47	7	16.5	37.5	15
I	4	3	2	2.5	2	2

Figure 8. Monitor-Well Construction Diagram.

Deficiencies in Monitoring Well Network

Several concerns have been identified by both the state regulatory agency and the EPA regional office, with regard to the adequacy of the monitoring well network. A "Compliance Evaluation Inspection" completed by the state regulatory agency in November 1983, following an on-site inspection, cited several deficiencies, and served notification of violation of state regulations.

First, as Figure 3a indicates, the bedrock surface rises quickly to the east under the impoundment. This results in a pinch-out of the sand and silt layer, comprising the first aquifer beneath the site. Consequently, the water table lies below the bedrock surface in this part of the site. The facility, after drilling well GM-3, apparently abandoned further efforts to locate another well that would be upgradient from the impoundment and still would tap into the first aquifer. Instead, they designated a drinking water production well (GM-0) located 2000 feet northwest of the impoundment to represent background groundwater conditions. As cited in the compliance report, this selection is questionable in several respects.

The well is pumped at a fairly high discharge (100-125 gpm) and so dilution of formation waters is certainly occurring. A second process water well is located downgradient from GM-0; the former is pumped at a rate of 600 gpm. The combined effects of the two wells is to produce a cone of depression, which at its deepest point is lower than the stage of the adjacent river to the west. Normally, the water table would slope upward away from the river, and so it is apparent that the pumping wells have considerable effect on the local groundwater setting. According to the compliance report, the two production wells may have the capacity to draw contaminants from other parts of the site to the "up-gradient well". As a result the placement of GM-0 does not appear to fulfill the requirements of 40 CFR 265.91(a)(1), 265.91(a)(1)(i), nor 265.91(a)(1)(ii). Furthermore, the well head is sealed, and the well is continuously pumped, making determination of water table elevations as required by 40 CFR 268.92(e), difficult. The well casing is constructed of 16 inch diameter welded steel, whereas the screen is 80 slot stainless steel. This may result in difficulty of evaluating sampling data from the two sets of wells, since the potential for adsorption/desorption of water quality constituents will differ between steel and PVC casing materials.

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The facility should have conducted more preliminary borings to try to locate a more appropriate location for the upgradient well. Alternatively, the GM-3 well could be deepened to intersect the water table in the shallowest permeable horizon of the bedrock. Though this would place the upgradient and downgradient wells in different stratigraphic horizons, this configuration would be preferable to the present one.

A second issue cited in the compliance report concerns the location and depths of the downgradient wells. As indicated in Figures 4 and 5, groundwater flow directions are predominantly due west, in both the perched and alluvial aquifers. However, the placement of wells GM-1, GM-2, and GM-6 are such that no well monitors the central portion of the impoundment. Furthermore, only the bottom 10 feet of each well is screened. This, in combination with the close proximity of the wells to the impoundments (30-70 feet) and the presence of a 8-28 foot thick clay layer underneath the impoundment, would "severely limit the capability of these wells to intercept a contaminant plume...The low permeability layer...could be expected to prevent downward migration of contamination...until it is beyond the monitoring wells...[and] render the present wells ineffective in detecting the presence of hazardous constituents which migrate from the regulated unit". Thus it appears that the facility may be in violation of 40 CFR 265.91(a)(2).

According to state regulatory personnel, the perched and semi-confined horizons do appear to be in hydraulic connection. This suggests that contamination of the perched layer could ultimately move to deeper levels of the near-surface aquifer. It appears then that both levels should be monitored (though the use of nested wells or well clusters) to provide adequate coverage of the near-surface aquifer in the monitoring network.

Other wells at the site do tap the perched layer, which as has been mentioned previously, does exhibit existing contamination. They are not sampled within the RCRA program, however, due to dry conditions during the summer. They could be sampled during the spring, and perhaps should be included in the monitoring network.

Results of sampling conducted by the state, as part of their compliance inspection, are listed in Table 3. Barium levels exceed EPA SDWA standards in well GM-1, while all three wells that were sampled exhibit detectable organic levels.

TABLE 3.

Samples collected on August 3, 1983

Chemical Analyses

(Analyses in mg/l unless otherwise stated)

Sampling Point

Parameter	GM-0	GM-1	GM-6
TOC	2	12	N.T.F.
Chloride	27	27	N.T.F.
Sulfate	121	1	N.T.F.
*Phenolics	1	4	N.T.F.
*Arsenic	<2	20	3
Lead	< .01	.03	.04
Barium	.06	1.2	.24
Cadmium	.001	.002	.003
*Mercury	< .1	.23	< .1

*Analyses in µg/l

N.T.F. = Not Tested For

(Analyses in µg/l)

Sampling Point

Parameter	Field Blank	GM-0	GM-1	GM-6
Methylene Chloride	N.D.	1.78	10	11.1
1,2-Dichloroethene	N.D.	N.D.	25.4	53.4
1,1,1-Trichloroethane	N.D.	N.D.	.688	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	11.0	24.5
Bromoform	N.D.	N.D.	3.40	5.91
Tetrachloroethene	N.D.	51.0	28.9	26.0
Chloroform	N.D.	N.D.	.916	1.60
Carbon Tetrachloride	N.D.	N.D.	1.27	2.12
Trichloroethene	N.D.	7.91	10.7	24.2
Benzene	N.D.	N.D.	4.10	7.0
1,4 Dichlorobenzene	N.D.	N.D.	5.0	8.0
1,2-Dichlorobenzene	N.D.	N.D.	10.1	15.7
Volatiles	N.D.	N.D.	N.D.	N.D.
Aromatics	N.D.	N.D.	N.D.	N.D.

N.D. = None Detected

SAMPLING AND ANALYSIS

Sampling and Analysis Plan

A copy of the facility's Sampling and Analysis Plan is included in Appendix B. This plan outlines the frequency of sampling, sampling parameters, required equipment, collection measures, sample preservation, analytic techniques, and chain of custody procedures. Sample preservation and analytical techniques are fairly well documented. Sampling collection procedures and chain of custody descriptions are rather brief. Furthermore, evacuation and sampling procedures as described in the plan differ from those actually employed in the field. For example, the written sampling plan specifies that a PVC bailer or Middlebury pump be used for well evacuation. Actually a Tole submersible pump is used for both evacuation and sample collection. Where methods have changed in the sampling protocol, the plan should be updated. It is also unclear which analytes are sampled at the facility and which are conducted at an off-site laboratory. This information should be included in the sampling and analysis plan.

Well evacuation prior to sampling is accomplished by a Tole submersible bladder pump. The device incorporates a nitrogen driven squeeze pump. No contact between the sample water and the gas takes place. The pump has a stainless steel body, a silicone rubber bladder, tygon check valves and tygon tubing and return lines. The bladder material is not appropriate for use in organic sampling due to the possibility for adsorption and desorption processes. Similarly, the tygon tubing is probably appropriate for inorganic analytes, but is not for organic constituents. The use of this equipment is puzzling in view of the statement in the facility's own sampling and analysis plan that Teflon is the preferable material for use in organic sampling. The operation of the pump also results in considerable turbulence, as noted by EPA staff during a recent on-site inspection. This would result in loss of volatiles and bias organic constituent analyses.

The bladder pump is rinsed three times with distilled water between each well evacuation. According to EPA guidance concerning sampling protocol at sites with potential organic contamination, cleaning with solvents between well evacuation episodes may be required to prevent cross-contamination problems. In

fact, the facility's written sampling plan suggests that an acetone or hexane rinse should be used to clean sampling equipment if organics are of concern. Apparently, the facility does not follow their plan in this regard.

The wells are pumped dry and then allowed to recover before sampling. This takes anywhere between 2 to 5 days. Estimates of transmissivity, calculated with Jacob's expression for well recovery data and assuming a period of recovery of 2 to 5 days, range from 8.25×10^{-5} to 5.10×10^{-4} cm/s. These are lower by an order of magnitude than the range of values cited in the facility's assessment report. So, the recovery periods may not be unreasonably long, however if the actual recovery periods are as stated, the long sampling periods may bias the sampling results, particularly the volatiles. In light of the apparent lengthy recovery times for some of the wells, it might be advisable to sample for a few constituents (particularly volatiles) as soon as sufficient volume permits, and continue to resample on a daily basis until all of the required sample volumes are collected.

The intake pump is consistently positioned 1 foot above the bottom of the well. Evacuated water is discharged to the ground, down-slope from the well casing. Nonetheless, the discharge of potentially contaminated water to the ground is poor practice.

The same pump is used to collect water quality samples. The samples are taken 1 foot from the bottom of the well. Inorganic samples are filtered and treated with preservatives in a laboratory adjacent to the impoundment. Phenol and TOC samples are fixed in the field. Sampling bottles are washed with detergent, then rinsed with hydrochloric acid, nitric acid, and finally distilled water, prior to sample collection. TOX sample bottles are solvent-washed, but apparently are not oven-baked. Sample caps are screw-type teflon-lined, while septums are 2.5 mw Tuffbond, manufactured by Pierce Co. The same 500ml glass sample bottle is used for the TOX samples and various pesticide samples, as indicated in the facility's sampling and analysis plan. Generally, 40ml bottles would be preferable for VOA's to minimize loss of volatiles during transport and storage. It is also good practice to minimize the number of sample splits required from a single container prior to actual analysis. Therefore, it would be preferable to use separate sample bottles for VOA's and pesticides.

Blanks are used in the laboratory for calibration of inorganic samples. No field blanks are employed. The facility has apparently not changed sampling

methods nor testing methods, but has changed testing laboratories since the initiation of groundwater monitoring.

Groundwater Assessment

In October, 1983, the facility notified the EPA regional office of statistically significant increases over background for TOC and specific conductivity. In fact, starting with the first quarter of sampling, at least one constituent was found to exceed EPA Interim Primary Drinking Water Standards (Appendix C and Table 4) during each round of sampling in each of the downgradient wells.

Table 4

Well	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
GM-0	No Parameters Exceeded Standards			
GM-1	Barium Radium Gross Alpha Gross Beta Coliform Bacteria	Barium Cadmium Coliform Bacteria	Arsenic Cadmium Lead	Arsenic Barium Coliform Bacteria
GM-2	Cadmium Gross Beta Coliform Bacteria	Cadmium Coliform Bacteria	Cadmium Coliform Bacteria	
GM-6	Cadmium Radium Gross Alpha Gross Beta Coliform Bacteria	Coliform Bacteria	Coliform Bacteria	Lead

The presence of elevated levels of coliform in some of the wells was attributed (by the facility) to drilling activity. Coliform levels do show a dramatic decrease after the first quarter of sampling. On the other hand, no drilling fluids were used in the well construction process, and so it is difficult to determine a specific source for the coliform from the drilling activity. An alternative explanation is the possibility of contaminated surface water infiltrating down the boreholes, although no sewer lines nor septic systems are located near the wells. Furthermore, the rapid decline in coliform levels after well construction would argue against contamination from an ongoing surface water source.

Lead and cadmium levels also exceeded standards in several wells. According to staff at the EPA regional office, there are no obvious sources of these constituents in the manufacturing or treatment processes at the facilities; the elevated levels may be indicative of background levels in the subsurface materials. Background levels of cadmium in natural soils range from 0.01 to 0.7 ppm; lead ranges from 2 to 200 ppm (EPA, 1983, Hazardous Waste Land Treatment, SW-874). The facility apparently also has problems with silty groundwater samples, and so a natural source for these two constituents may be conceivable.

The facility claimed that the differences in downgradient and reference samples were the result of "natural variations in fluid chemistry resulting from lithologic differences in aquifer materials and/or remnants of seepage from a brine storage facility that occupied this site about twenty years prior to the installation (lining of the existing basin) of the mercury surface impoundment." The facility embarked on a groundwater assessment program to determine the likely sources of specific conductivity and TOC. The proposed Water Quality Assessment Program (as described in Appendix D) essentially involves collecting a set of replicate samples from the impoundment and the downgradient wells, analysis of the samples for selected water quality parameters, comparison of constituent ratios (e.g. Na/Cl ratios) for the impoundment and well samples, notification of the regional EPA office following the completion of the analysis, and preparation of a report documenting the results of the program. An implementation schedule is also included with the assessment outline, with a start-up date preceding the date of the notification letter and a completion date two months later.

The assessment outline is rather vague about the proposed steps, given a determination that the impoundment does represent a likely source for the elevated TOC and specific conductivity levels. The outline mentions possible additional sampling and analyses of groundwater and surface impoundment fluids. As part of a complaint and consent order issued by the regional EPA office, the facility was cited for violations of 40 CFR 265.93(d)(2) and 265.93(d)(3). The violations resulted from insufficient detail of sampling and analysis procedures in the proposed assessment, and failure to have the plan certified by a qualified geologist or geotechnical engineer. Furthermore, the plan did not address the issues of rate and extent of migration of the waste constituents, as required by 40 CFR 265.93 (d)(4)(i).

The facility's consultant conducted the Groundwater Quality Assessment Program during the fall of 1983 and submitted their findings in December, 1983. Results of the two rounds of sampling collected during the study are shown in Table 5.

Three general conclusions were drawn from the study by the hydrogeologic consultant: (1) the elevated TOC and specific conductivity levels did not result from leakage of the present mercury impoundment, (2) statistically higher TOC values in the downgradient wells (relative to background) result from a greater proportion of natural organic sources (coal and disseminated organic matter) in the downgradient well area, and (3) statistically higher specific conductivity levels in the downgradient wells represent residual contamination from the previous concrete-lined brine storage pond.

The rationale that naturally occurring organics are the source of observed TOC values, is based on comparison of TOC levels in the monitoring wells with "natural TOC levels [which] typically range from <5 to 10 or more . . . mg/l," (as stated in the consultant's report). TOC levels ranged from 3.1 to 9.0 mg/l in the downgradient wells during the assessment sampling, although values 2-3 times as high have been recorded in GM-1 during recent split sampling runs. The facility's consultant also suggests that the finer-grained sediments, in which the downgradient wells are set, contain a higher proportion of organic matter (e.g. coal fragments) than the sand and gravel alluvial deposits of the GM-0 well. Unfortunately, the lithological log for the GM-0 well is not very detailed (Appendix A) and so it is difficult to evaluate this point. Another problem is that since all the downgradient wells are downgradient from the impoundment, it is difficult to separate the effects of the influence of natural organics and possible leakage from the present or previous impoundments. One way to test whether the two sets of lithologies do have different ambient TOC levels, would be to perform additional borings and water quality sampling upgradient from the impoundment site (or far enough away from the impoundment to insure against possible contamination from the pre-existing or existing impoundments).

Another possible explanation for the difference between downgradient and reference well TOC levels is possible dilution of constituents in the production well. This possibility is not discussed in the assessment report.

The report also states that the facility "has not stored or disposed of synthetic organic compounds in the [impoundment area], (as evidenced by low TOX values)". Yet the results of the most recent split sampling do show detectible levels of TOX in the monitoring wells. Several chlorinated organics could be used (or formed) in the mercury cell process and it is possible that some could end up in the impoundment fluids. Whatever the rationale for the downgradient increase in organics, the facility should have conducted a more detailed screening of organics (using GC/MS techniques) to identify individual constituents. Failure to do this would constitute a violation of 40 CFR 265.93(d).

The facility did conduct further sampling of specific organic constituents in the impoundment fluids at the same time the split samples were collected (March 23, 1984). The results of this round of sampling is shown in Table 5.

The assessment report also discusses the problem of observed elevated downgradient specific conductivity levels. Reference to Table 7, which contains results of detection monitoring data for 1982, suggests that the higher specific conductivity levels in the downgradient wells result from relatively higher concentrations of total dissolved solids, chloride, sodium, magnesia, and iron. Tables 6 and 7 also indicate, according to the assessment report, that downgradient well and impoundment fluids have "vastly different" chemical characteristics, namely:

- o downgradient wells show near neutral pH values, while impoundment fluids show very high pH levels (11.6 to 12.0),
- o dissolved mercury is negligible in downgradient wells, whereas it is present in concentrations of about 350 g/l in the impoundment, and
- o downgradient wells show relatively high Na/Cl ratios (1.6 to 6.8), in contrast to the impoundment with ratios ranging from .72 to .76.

The three points, however, do not make a convincing case for two separate fluid chemistries. The near-neutral pH values in the downgradient wells might result from dilution of impoundment fluids in the groundwater stream. The lower mercury levels may reflect adsorption on clay particles in the subsurface materials.

The third point suggests, as mentioned by the consultant, that the impoundment is not the source of the elevated constituents in the downgradient wells, nor is the residual contamination from the pre-existing brine pond! Yet considerable visual evidence and other statements made by the facility, indicate that the brine pond did, in fact, leak and is responsible for much of the existing inor-

TABLE 5 RESULTS OF IMPOUNDMENT SAMPLING ON 3/23/84

(analysis in ppb)

	Mercury Pond <u>3/23/84</u>
Methylene Chloride	4
Trans-1,2-Dichloroethane	<1
Chloroform	6
Cis-1,2-Dichloroethane	<1
Carbon Tetrachloride	<1
Benzene	20
Trichloroethane	3.0
1,1,2-Trichloroethane	<1
Tetrachloroethane	3
Bromoform	<1
1,4-Dichlorobenzene	<10
1,2-Dichlorobenzene	<10
1,1-Dichloroethane	<1
1,1,1-Trichloroethane	<1
1,2-Dichloroethane	<1
Monochlorobenzene	<10
1,1,2,2-Tetrachloroethane	<10
1,3-Dichlorobenzene	<10
Hexachloroethane	<10
1,2,4-Trichlorobenzene	<10
1,2,3-Trichlorobenzene	<10
Unknowns	<10
Volatiles	
Aromatics	

ND = none detected

Analytical method on following laboratory report

TABLE 6
RESULTS OF CHEMICAL ANALYSES CONDUCTED DURING THE WATER-QUALITY ASSESSMENT PROGRAM
AT THE MERCURY POND FACILITY
(all values expressed in mg/l unless otherwise specified)

Well Location	pH (std. units)	SC (umhos/cm)	TOC	TDS	Total ALK. (as CaCO ₃)	HCO ₃ ⁻	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	SiO ₂	Hg (ug/l)	Na/Cl
<u>10/19/83 Sample Set</u>																	
GM-0	6.9	678	1.2	425	212	259	19	84	-	-	-	-	-	-	-	-	-
GM-1	7.1	1158	9.0	650	602	73	18	<10	122	1.4	100	29	0.1	1.0	11.5	<0.5	6.8
GM-2	7.0	1355	5.7	758	596	727	79	<10	172	3.0	99	23	0.9	1.7	13.4	<0.5	2.2
GM-6	7.3	1050	7.4	635	207	253	61	188	97	2.7	98	16	<0.1	0.7	8.5	<0.5	1.6
Hg Pond	11.6	91625	4.0	85950	1424	1737	49000	1640	35200	19.4	13	<1	<0.1	<0.02	31.4	347	0.72
<u>10/27/83 Sample Set</u>																	
GM-0	7.1	719	1.4	485	202	246	27	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1178	8.1	675	599	731	49	<10	123	1.5	103	28	10.7	1.1	11.8	0.5	2.5
GM-2	7.0	1369	3.1	743	579	706	84	<10	203	3.2	92	21	5.1	1.5	13.8	<0.5	2.4
GM-6	7.2	1055	5.5	610	202	248	69	177	X	X	X	X	X	X	X	X	X
Hg Pond	12.0	61500	3.9	52400	5854	7142	29000	840	22000	17.4	16	0.1	.1	<0.02	19.3	350	0.76
<u>Mean Average of 10/19/83 and 10/27/83 Data</u>																	
GM-0	7.0	699	1.3	455	207	253	23	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1168	8.6	663	601	753	34	<10	123	1.5	102	29	5.4	1.1	11.7	<0.5	3.6
GM-2	7.0	1362	4.4	751	588	717	82	<10	188	3.1	96	22	3.0	1.6	13.6	<0.5	2.3
GM-6	7.3	1053	6.5	623	205	250	65	183	97*	2.7*	98*	16*	<0.1*	0.7*	8.5*	<0.5*	1.6*
Hg Pond	11.8	76563	4.0	69175	3639	4441	39000	1240	28600	19.4	15	<1	<0.1	<0.02	25.4	349	0.73

- Not analyzed

X Insufficient sample volume for analyses

* Value based entirely on 10/19/83 data

TABLE 7.
AVERAGED RESULTS OF WATER-QUALITY ANALYSES CONDUCTED DURING 1982 DETECTION MONITORING
AT THE MERCURY POUD FACILITY
(averages represent mean of 1/4/82, 5/10/82, 8/3/82, and 11/15/82 water-quality data;
all values are expressed in mg/l unless otherwise specified)

Well Number	pH (Std. units)	SC (unhos/cm)	TOC	TOX (ug/l)	TDS	Total Alk. (as CaCO ₃)	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	Hg (ug/l)	NH ₄ /Cl
Q1-0	7.1	618	3	49	399	287	350	21*	80	11	2	108	11	0.1	<0.01	<0.2	0.5
Q1-1	7.2	995	17	77	619	506	617	25	4	136	2	116	32	29	1.5	<0.5	5.4
Q1-2	7.1	1249	7	48	779	504	615	69	9	245	5	107	25	11	2.7	<0.5	3.6
Q1-6	7.2	896	10	26	585	259	317	68	123	130	5	103	15	6	2.1	0.4	1.9

* Median value used because of anomalously high result in 1/4/82 analysis.

ganic contamination at the site. The consultant then explains how an initially low Na/Cl ratio (from the leaking brine pond fluid) could be changed over time to reflect the currently observed ratios, for example differential sorption or desorption of sodium and chloride from clay-rich sediments. It would appear that these mechanisms could also affect the Na/Cl ratios of fluids that might be leaking from the present impoundment. In short, the Na/Cl data is equivocal. Further analysis should be conducted to determine the period of flushing required to remove all of the pre-existing contamination. This could be done by estimating the mass of constituents released from the concrete-lined impoundment over its active life (e.g. based on a Darcian flow law) and the observed groundwater flux rates in the shallow aquifer system. This will give at least a rough indication of how much residual brine contamination remains at the site. Column tests could be run in the laboratory to determine whether adsorption/desorption processes could effect subsurface changes in Na/Cl ratios of the existing impoundment fluids. In the absence of more definitive data, and the continuing problem of an inadequate number and questionable location of the monitoring wells, the assessment appears to be of limited value.

Split Sampling Results

Results of the split sampling conducted during the site visit are presented in Appendix E. A comparison of the results from the facility and EPA laboratories show some differences for inorganic and organic constituents, Tables 8 and 9. Significant differences between facility and EPA Samples were found for specific wells and constituents, (indicated by boxes in Table 8) but consistently large differences between the data sets are not obvious. It is perhaps surprising that certain samples are very similar in the facility and EPA data, while in isolated examples, large differences are apparent. Levels of specific conductivity and TDS are marginally higher in the facility samples. Chloride levels are also higher in the facility samples and the majority of samples are different by a factor of 2 or greater. Sulfate levels, on the other hand, tend to be higher in the EPA samples. The absence of major differences between the two data sets for the majority of constituents does not point to any obvious differences in sampling protocols that might explain the relatively few anomalous examples.

Table 8. COMPARISON OF INORGANIC SPLIT SAMPLING RESULTS

	GM-0	GM-1	GM-2	GM-5	GM-6	GM-7
pH (Su)						
EPA	7.12	7.40	7.58	7.38	7.49	7.88
FACILITY	6.95	7.1	7.07	6.87	6.97	6.72
ALKALINITY						
CaCO ₃ (mg/l)						
EPA	186	576	568	320	232	434
FACILITY	204	603	562	307	263	344
SPECIFIC CONDUCTIVITY						
(mhos)						
EPA	601	1020	1170	731	883	984
FACILITY	704	1165	1412	864	1127	1235
TDS (mg/l)						
EPA	399	634	721	452	585	598
FACILITY	398	633	583	450	570	460
CHLORIDE (mg/l)						
EPA	19.2	<0.3	<0.3	1.1	56.0	1.1
FACILITY	22	18	.79	32	61	62
SULFATE (mg/l)						
EPA	87.4	2.7	5.7	51.2	161	28.2
FACILITY	35	3	5	29	71	25
PHENOL (mg/l)						
EPA	<0.03	<0.03	-	<0.03	-	-
FACILITY	0.007	0.008	-	0.003	-	-
TOC (mg/l)						
EPA	6.4	2.0	2.0	1.8	4.3	2.8
FACILITY	9.4	28	14.3	1.5	5.1	8.45
TOX (µg/l)						
EPA	93	28	-	12	-	-
FACILITY	82	<20-20	<20-20	<20	67.5	<20-20

Table 8 (Continued)

	GM-0	GM-1	GM-2	GM-5	GM-6	GM-7
CALCIUM (mg/l)						
EPA	130	118	113	119	95.6	-
FACILITY	116	97.2	95.1	112	56.6	112
COPPER (µg/l)						
EPA	6.1	0.8	3.2	2.4	1.8	-
FACILITY	<10	<10	<10	<10	<10	<10
IRON (µg/l)						
EPA	34	34	24	20	45	-
FACILITY	<10	100	100	<10	<10	20.9
MAGNESIUM (mg/l)						
EPA	8.92	25.1	19.3	20.5	9.53	-
FACILITY	10.0	26.1	20.0	21.5	5.5	20.9
MANGANESE (mg/l)						
EPA	0.004	0.913	1.31	0.179	0.685	-
FACILITY	<0.01	0.91	1.34	0.23	0.25	3.70
MERCURY (µg/l)						
EPA	<0.1	<0.1	<0.1	<0.1	<0.1	-
FACILITY	0.2	0.2	0.2	0.3	<0.2	0.2
POTASSIUM (mg/l)						
EPA	1.78	1.70	3.96	1.51	2.59	-
FACILITY	2.00	1.30	2.90	1.50	2.40	1.80
SODIUM (mg/l)						
EPA	12.5	140	187	41.7	112	-
FACILITY	13.2	119	171	42.9	91.6	86.4
VANADIUM (µg/l)						
EPA	22	<7	<7	27	84	-
FACILITY	<10	10	<10	<10	<10	<10
ZINC (mg/l)						
EPA	0.15	0.13	0.15	0.15	0.14	-
FACILITY	<0.1	0.3	0.10	0.10	0.10	0.10

Table 8 (Continued)

	GM-0	GM-1	GM-2	GM-5	GM-6	GM-7
LEAD (mg/l)						
EPA						
FACILITY	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Boxes indicate differences between the facility and EPA laboratory results by a factor of 2 or greater (except for Calcium in GM-6).

Organic results showed some differences between the facility and EPA data, as well. Higher TOC levels were observed in the facility data for all wells except GM-5. TOX levels were comparable in the two sets of samples. Organic constituents were detected in the facility and EPA samples in all wells (Table 9). In well GM-0, trichloroethene and tetrachloroethene were found at comparable levels in the two sets of splits.

Otherwise, two sets of results indicate completely different compounds; phenol, benzene and ortho-dichlorobenzene in the facility samples; acrylonitrile, 1, 2 trichloroethane, acetone, butanone, and methylene chloride in the EPA samples.

A difference in holding times for the VOA's may explain some of the major differences between the two sets of data. The facility splits were reported on April 9, 1984, whereas the EPA samples were not analyzed until June 19. The EPA samples were held in excess of recommended holding times, and this may have resulted in loss of the more volatile constituents (such as benzene) and the introduction of substances to the samples from the ambient laboratory environment (acetone and methylene chloride). Less volatile chlorinated hydrocarbons were apparently not affected as much by the long holding times, hence the similarity of sample results in GM-0 for trichloroethene and tetrachloroethene.

It is not known why the GM-0 well (supposedly the "upgradient" well) shows higher organic levels than the remaining wells in the EPA data. One possible explanation for the latter is that well GM-0 is located near the middle of the plant proper; hence it may be affected by periodic spills of organic feed-stock materials used in other parts of the facility's manufacturing process.

Furthermore, since it is a production well it may tend to pull in water from different areas of the plant, some of which may have been affected by spills of organic material.

Table 9. COMPARISON OF ORGANIC SPLIT SAMPLING RESULTS

	GM-0	GM-1	GM-2	GM-5	GM-6	GM-7
BENZENE (ppm)	0.02	0.03	0.02	0.01	0.02	
ORTHO-DICHLOROBENZENE (ppm)					0.02	0.02
TRICHLOROETHENE (ppb)	7 12.5					
TETRACHLOROETHENE (ppb)	153 134					
ACRYLONITRILE ($\mu\text{g/l}$)	8.5					
1, 2 TRICHLOROETHANE ($\mu\text{g/l}$)	11					
ACETONE ($\mu\text{g/l}$)	25.3	29.4	34.5	14	9	6.8
BUTANONE ($\mu\text{g/l}$)	6.8					
METHYLENE-CHLORIDE ($\mu\text{g/l}$)		6.1	13.9		11.7	10.4

Boxes indicate detectable levels of organics in EPA splits; circles refer to facility splits



INDUSTRIES

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

Natrium Plant
Industrial Chemical Division

June 26, 1984

RCRA COMPLIANCE SECTION
RECEIVED
JUL 5 1984

Mr. William Myers
U.S. EPA WH 562
401 M Street, SW
Washington, DC 20460

Dear Mr. Myers:

Attached are the analytical results from our
March split sampling.

A quick look did not indicate any major differences except for the acetone and methylene chloride which we did not confirm in the amounts shown by your laboratory. I did not include methods and chain of custody documents, but they are, of course, available.

Sincerely,

Kenneth S. Walborn
Manager, Environmental Control

KSW/egm

Enclosures

cc: ✓ Douglas Donor, EPA
Paul Montney, EPA
Robert L. Jelacic, DNR

PPG INDUSTRIES, INC.
Chemical Division — Natrium
LABORATORY DEPT.

09C

Date Rec'd.: 3-23-84

W.O. # 635521

Type Sample: G.M. - Hg Pond Series

Sample No.: G.M. - O 08984

Submitted By: C. Haight K Swallow

Dept.: Technical

Report To: C. Haight

Date Reported: 5-14-84

Notebook No.:

Page No.:

	ANALYSIS REQUIRED	UNITS	REPLICATES	GUIDE LIMITS	RESULTS
GROUND H ₂ O CONTAM. INDICATORS	pH		4	6.5 - 8.5	7.0 6.9 6.9 7.0
	Specific Cond.	uMhos	4		698 711 706 700
	TOC	mg/l	4		11.3 9.7 8.6 8.2
	TOX	ug/l Cl	4		90 80 80 80
GROUND H ₂ O QUALITY PARAMETERS	Cl	mg/l	1	- 250 mg/l	22
	SO ₄	mg/l	1	-250 mg/l	35
	Fe	mg/l	1	-0.3 mg/l	<0.1
	Mn	mg/l	1	-0.05 mg/l	<0.01
	Na	mg/l	1		13.2
	Phenol	mg/l	1		.007
ADDITIONAL	Alkalinity(CaCO ₃)	mg/l	1		204
	Alkalinity(HCO ₃)	mg/l	1		249
	Color	APHA	1	-15	<5
	TDS	mg/l	1	-500 mg/l	398
	Ca	mg/l	1		116.
	Cu	mg/l	1	-1 mg/l	<0.01
	K	mg/l	1		2.00
	Zn	mg/l	1	-5 mg/l	<0.1
	Mg	mg/l	1		10.0
	V	mg/l	1		<0.01
	Hg	ug/l	1	-2 ug/l	0.2
	Pb	mg/l	1	-0.05	<0.005

PPG INDUSTRIES, INC.
Chemical Division - Natrium
LABORATORY DEPT.

Date Rec'd.: 3-23-84

W.O. # 63552

Type Sample: G.M. - Ho Pond Series

Sample No.: GM-1

Submitted By: C. Haught Ksu

Dept.: Technical

Report To: C. Haught

Date Reported: 5-14-84

Notebook No.:

Page No.:

	ANALYSIS REQUIRED	UNITS	REPLICATES	GUIDE LIMITS	RESULTS
GROUND H ₂ O CONTAM. INDICATORS	pH		4	6.5 - 8.5	7.1 7.1 7.1 7.1
	Specific Cond.	uMhos	4		1120 1170 1180 1190
	TOC	mg/l	4		30.3 29.1 25.8 25.1
	TOX	ug/l Cl	4		20. 20. <20. <20.
GROUND H ₂ O QUALITY PARAMETERS	Cl	mg/l	1	- 250 mg/l	18
	SO ₄	mg/l	1	-250 mg/l	3
	Fe	mg/l	1	-0.3 mg/l	0.1
	Mn	mg/l	1	-0.05 mg/l	0.91
	Na	mg/l	1		119.
	Phenol	mg/l	1		.008
ADDITIONAL	Alkalinity(CaCO ₃)	mg/l	1		603
	Alkalinity(HCO ₃)	mg/l	1		736
	Color	APHA	1	-15	45
	TDS	mg/l	1	-500 mg/l	633
	Ca	mg/l	1		97.2
	Cu	mg/l	1	-1 mg/l	<0.01
	K	mg/l	1		1.30
	Zn	mg/l	1	-5 mg/l	0.3
	Mg	mg/l	1		26.1
	V	mg/l	1		0.01
	Hg	ug/l	1	-2 ug/l	0.2
	Pb	mg/l	1	-0.05 mg/l	<0.005

PPG INDUSTRIES, INC.
Chemical Division - Natrium
LABORATORY DEPT.

096

Date Rec'd.: 3-23-84

W.O. # 63552 C

Type Sample: GM-Hg Bond Series

Sample No.: GM-2

Submitted By: C. Haught

Dept.: Technical

Report To: C. Haught

Date Reported: 5-14-84

Notebook No.:

Page No.:

	ANALYSIS REQUIRED	UNITS	REPLICATES	GUIDE LIMITS	RESULTS
GROUND H ₂ O CONTAM. INDICATORS	pH		4	6.5 - 8.5	7.0 7.1 7.1 7.1
	Specific Cond.	uMhos	4		1400 1420 1420 1410
	TOC	mg/l	4		16.2 15.0 13.8 12.1
	TOX	ug/l Cl	4		<20 20 <20 <20
GROUND H ₂ O QUALITY PARAMETERS	Cl	mg/l	1	- 250 mg/l	79
	SO ₄	mg/l	1	-250 mg/l	5
	Fe	mg/l	1	-0.3 mg/l	0.1
	Mn	mg/l	1	-0.05 mg/l	1.34
	Na	mg/l	1		171.
	Phenol	mg/l	1		INSUFFICIENT SAMPLE
ADDITIONAL	Alkalinity(CaCO ₃)	mg/l	1		562
	Alkalinity(HCO ₃)	mg/l	1		686
	Color	APHA	1	-15	<5
	TDS	mg/l	1	-500 mg/l	583
	Ca	mg/l	1		95.1
	Cu	mg/l	1	-1 mg/l	<0.01
	K	mg/l	1		2.90
	Zn	mg/l	1	-5 mg/l	0.1
	Mg	mg/l	1		20.0
	V	mg/l	1		<0.01
	Hg	ug/l	1	-2 ug/l	0.2
	Pb	mg/l	1	0.05	<0.005

PPG INDUSTRIES, INC.
Chemical Division — Sodium
LABORATORY DEPT.

Date Rec'd.: 3-23-84

W.O. # 63552

Type Sample: GM - Ho Pond Series

Sample No.: GM-5

Submitted By: C. Haight

Dept.: Technical

Report To: C. Haight

Date Reported: 5-14-84

Notebook No.: _____

Page No.: _____

	ANALYSIS REQUIRED	UNITS	REPLICATES	GUIDE LIMITS	RESULTS
GROUND H ₂ O CONTAM. INDICATORS	pH		4	6.5 - 8.5	6.8 6.9 6.9 6.9
	Specific Cond.	uMhos	4		856 865 867 869
	TOC	mg/l	4		1.5 1.5 1.5 1.5
	TOX	ug/l Cl	4		<20 <20 <20 <20
GROUND H ₂ O QUALITY PARAMETERS	Cl	mg/l	1	- 250 mg/l	32
	SO ₄	mg/l	1	-250 mg/l	29
	Fe	mg/l	1	-0.3 mg/l	<0.1
	Mn	mg/l	1	-0.05 mg/l	0.23
	Na	mg/l	1		42.9
	Phenol	mg/l	1		.003
ADDITIONAL	Alkalinity(CaCO ₃)	mg/l	1		307
	Alkalinity(HCO ₃)	mg/l	1		375
	Color	APHA	1	-15	<5
	TDS	mg/l	1	-500 mg/l	450
	Ca	mg/l	1		112.
	Cu	mg/l	1	-1 mg/l	<0.01
	K	mg/l	1		1.50
	Zn	mg/l	1	-5 mg/l	0.1
	Mg	mg/l	1		21.5
	V	mg/l	1		<0.01
	Hg	ug/l	1	-2 ug/l	0.3
	Pb	mg/l	1	-0.05 mg/l	<0.005

Chemical Division - Natrium
LABORATORY DEPT.

Date Rec'd.: 3-23-84

Type Sample: G.M.-Hg Pond Series

W.O. # 635521

Submitted By: E. Haught

Sample No.: G.M.-6

Report To: C. Haught

Dept.: Technical

Date Reported: 5-14-84

Notebook No.:

Page No.:

	ANALYSIS REQUIRED	UNITS	REPLICATES	GUIDE LIMITS	RESULTS
GROUND H ₂ O CONTAM. INDICATORS	pH		4	6.5 - 8.5	6.9 7.0 7.0 7.0
	Specific Cond.	uMhos	4		1120 1130 1130 1130
	TOC	mg/l	4		5.2 5.1 5.1 5.1
	TOX	ug/l Cl	4		70. 70 60, 70.
GROUND H ₂ O QUALITY PARAMETERS	Cl	mg/l	1	- 250 mg/l	61
	SO ₄	mg/l	1	-250 mg/l	71
	Fe	mg/l	1	-0.3 mg/l	<0.1
	Mn	mg/l	1	-0.05 mg/l	0.25
	Na	mg/l	1		91.6
	Phenol	mg/l	1		INSUFFICIENT SAMPLE
ADDITIONAL	Alkalinity(CaCO ₃)	mg/l	1		263
	Alkalinity(HCO ₃)	mg/l	1		321
	Color	APHA	1	-15	25
	TDS	mg/l	1	-500 mg/l	570
	Ca	mg/l	1		56.6
	Cu	mg/l	1	-1 mg/l	<0.01
	K	mg/l	1		2.40
	Zn	mg/l	1	-5 mg/l	0.1
	Mg	mg/l	1		5.5
	V	mg/l	1		<0.01
	Hg	ug/l	1	-2 ug/l	<0.2
	Pb	mg/l	1	0.05 mg/l	<0.005

PPG INDUSTRIES, INC.
Chemical Division — Natrium
LABORATORY DEPT.

(d)C

Date Rec'd.: 3-23-84

W.O. # 635520

Type Sample: GM-Ha Pond Series

Sample No.: GM-7

Submitted By: C. Haught RW

Dept.: Tuckahoe

Report To: C. Haught

Date Reported: 5-14-84

Notebook No.:

Page No.:

	ANALYSIS REQUIRED	UNITS	REPLICATES	GUIDE LIMITS	RESULTS
GROUND H ₂ O CONTAM. INDICATORS	pH		4	6.5 - 8.5	6.7 6.7 6.7 6.8
	Specific Cond.	uMhos	4		1213 1240 1248 1238
	TOC	mg/l	4		9.2 8.6 8.4 7.6
	TOX	ug/l Cl	4		<20 - <20 20 20
GROUND H ₂ O QUALITY PARAMETERS	Cl	mg/l	1	- 250 mg/l	62
	SO ₄	mg/l	1	-250 mg/l	25
	Fe	mg/l	1	-0.3 mg/l	<0.1
	Mn	mg/l	1	-0.05 mg/l	3.70
	Na	mg/l	1		86.4
	Phenol	mg/l	1		INSUFFICIENT SAMPLE
ADDITIONAL	Alkalinity(CaCO ₃)	mg/l	1		344
	Alkalinity(HCO ₃)	mg/l	1		420
	Color	APHA	1	-15	<5
	TDS	mg/l	1	-500 mg/l	460
	Ca	mg/l	1		112.
	Cu	mg/l	1	-1 mg/l	<0.01
	K	mg/l	1		1.80
	Zn	mg/l	1	-5 mg/l	0.1
	Mg	mg/l	1		20.9
	V	mg/l	1		<0.01
	Hg	ug/l	1	-2 ug/l	0.2
	Pb	mg/l	1	-0.05	<0.005

Date received: 3-30-84

U.O. # 635520

Sampled by: E. Haught

Dept. Environmental

Report To: E. Haught

Date reported: 4-9-84

Data stored: Lab file

TABLE II

Geraghty-Miller Well Water Samples

Parts Per Million Chlorobenzenes Etc. Compounds*										
Well	Benzene	MCB	1,1,2,2 C ₂ H ₂ Cl ₄	Meta DCB	Para DCB	Ortho DCB	1,2,4 TCB	1,2,3 TCB	C ₂ Cl ₆	# of Unknowns
08984-GM-0	.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	1
08984-GM-1	.03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	0
08984-GM-2	.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	0
08984-GM-5	.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	1
08984-GM-6	.02	<.01	<.01	<.01	<.01	.02	<.01	<.01	<.01	1
08984-GM-7	<.01	<.01	<.01	<.01	<.01	.02	<.01	<.01	<.01	0

*Flame Ionization G/C - CS₂ ExtractionJ. Bogdan
4-9-84

Date received: 3-30-84

Sampled by: E. Haught

W.O. # 635520

Report to: E. Haught

Dept: Environmental

Data stored: Lab file

Date reported: 4-9-84

TABLE I

Genaghty Well Water Samples
MillerParts Per Billion Chloro C₁ & C₂ Compounds*

Well	CH ₂ Cl ₂	CHCl ₃	1,1,1 C ₂ H ₃ Cl ₃ and or 1,2 C ₂ H ₄ Cl ₂	CCl ₄	C ₂ HCl ₃	C ₂ Cl ₄	# of Unknowns
08984-GM-0	< 1	< 1	< 1	< 1	7.	153.	1
08984-GM-1	< 1	< 1	< 1	< 1	< 1	< 1	0
08984-GM-2	< 1	< 1	< 1	< 1	< 1	< 1	0
08984-GM-5	< 1	< 1	< 1	< 1	< 1	< 1	0
08984-GM-6	< 1	< 1	< 1	< 1	< 1	< 1	0
08984-GM-7	< 1	< 1	< 1	< 1	< 1	< 1	0

*Tracor 700 A (Hall Electrolytic Conductivity Detector) G/C - Headspace Technique
Samples & Standards Equilibrated at 40°C ± 0.1°C.

J. Bogdan
4-9-84



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

2859
RECEIVED JUN 25 1984

G.W

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

PPG Industries

WVD 00 433 6343

6/22/84

Kenneth S. Walborn
PPG Industries, Inc.
Natrium Plant
P.O. Box 191
New Martinsville, WV 26155

Dear Mr. Walborn:

Attached are the analytic results from our March split sampling. I would appreciate your sending me a copy of PPG's as soon as they become available so I can complete my case history write-up. You will be receiving a copy of this as soon as it is written and peer reviewed. Your cooperation in this project is greatly appreciated.

Sincerely,

A handwritten signature in cursive script that reads "William Myers".

William Myers
Program Analyst

Mail Stop WH-562

PEDCO ENVIRONMENTAL, INC.
11499 CHESTER ROAD
CINCINNATI, OHIO 45246
(513) 782-4700

LABORATORY ANALYSIS REPORT

SAMPLE TYPE: WELL WATERS

CLIENT: U.S. EPA
OFFICE OF SOLID WASTE

PROJECT NO: 3627-1
REQUISITION: 5414
RECEIVED: 3/30/84
SAMPLE SITE: PPG
NEW MARTINSVILLE, WV
REPORTED: 5/10/84

ATTN: MR. WILLIAM MYERS

SAMPLE ID PEDCO NO.	GM-0 DL219	GM-1 DL220	GM-2 DL221
PARAMETER, UNITS			
PH, SU	7.12	7.40	7.58
ALKALINITY, MG/L CaCO_3	186	576	568
SPECIFIC CONDUCTANCE, UMHOS	601	1020	1170
DISSOLVED SOLIDS, MG/L	399	634	721
CHLORIDE, MG/L	19.2	<0.3	<0.3
SULFATE, MG/L	87.4	2.7	5.7
COLOR, CHLOROPLATINATE NO.	<1	17	6
PHENOLICS, MG/L	<0.03	<0.03	NR
TOTAL ORGANIC CARBON, MG/L	6.4	2.0	2.0
TOTAL ORGANIC HALOGEN, UG/L	93	28	NR
CALCIUM, MG/L	130	118	113
COPPER, UG/L	6.1	0.8	3.2
IRON, UG/L	34	34	24
MAGNESIUM, MG/L	8.92	25.1	19.3
MANGANESE, MG/L	0.004	0.913	1.31
MERCURY, UG/L	<0.1	<0.1	<0.1
POTASSIUM, MG/L	1.78	1.70	3.96
SODIUM, MG/L	12.5	140	187
VANADIUM, UG/L	22	<7	<7
ZINC, MG/L	0.15	0.13	0.15

NR = NOT REQUESTED

SUBMITTED BY:

Craig H Caldwell

PEDCO ENVIRONMENTAL, INC.
11499 CHESTER ROAD
CINCINNATI, OHIO 45246
(513) 782-4700

LABORATORY ANALYSIS REPORT

SAMPLE TYPE: WELL WATERS

CLIENT: U.S. EPA
OFFICE OF SOLID WASTE

PROJECT NO: 3627-1
REQUISITION: 5414
RECEIVED: 3/30/84
SAMPLE SITE: PPG
NEW MARTINSVILLE, WV
REPORTED: 5/10/84

ATTN: MR. WILLIAM MYERS

SAMPLE ID PEDCO NO.	GM-5 DL222	GM-6 DL223	GM-7 DL224
PARAMETER, UNITS			
PH, SU	7.38	7.49	7.88
ALKALINITY, MG/L CaCO_3	320	232	434
SPECIFIC CONDUCTANCE, UMHOS	731	883	984
DISSOLVED SOLIDS, MG/L	452	585	598
CHLORIDE, MG/L	1.1	56.0	1.1
SULFATE, MG/L	51.2	161	28.2
COLOR, CHLOROPLATINATE NO.	6	22	3
PHENOLICS, MG/L	<0.03	NR	NR
TOTAL ORGANIC CARBON, MG/L	1.8	4.3	2.8
TOTAL ORGANIC HALOGEN, UG/L	12	NR	NR
CALCIUM, MG/L	119	95.6	NR
COPPER, UG/L	2.4	1.8	NR
IRON, UG/L	20	45	NR
MAGNESIUM, MG/L	20.5	9.53	NR
MANGANESE, MG/L	0.179	0.685	NR
MERCURY, UG/L	<0.1	<0.1	NR
POTASSIUM, MG/L	1.51	2.59	NR
SODIUM, MG/L	41.7	112	NR
VANADIUM, UG/L	27	84	NR
ZINC, MG/L	0.15	0.14	NR

NR = NOT REQUESTED

SUBMITTED BY:

Craig H Caldwell

PEDCO ENVIRONMENTAL, INC.
11499 CHESTER ROAD
CINCINNATI, OHIO 45246
(513) 782-4700

LABORATORY ANALYSIS REPORT
METHODS USED FOR ANALYSES

CLIENT: U.S. EPA
OFFICE OF SOLID WASTE

PROJECT NO: 3627-1
REQUISITION: 5414
RECEIVED: 3/30/84
SAMPLE SITE: PPG
NEW MARTINSVILLE, WV
REPORTED: 5/10/84

ATTN: MR. WILLIAM MYERS

PARAMETER	METHOD
PH	EPA 150.1
ALKALINITY	EPA 310.1
SPECIFIC CONDUCTANCE	EPA 120.1
DISSOLVED SOLIDS	APHA 209C
CHLORIDE	EPA 325.3
SULFATE	EPA 375.4
COLOR	EPA 110.2
PHENOLICS	EPA 420.1
TOTAL ORGANIC CARBON	EPA 415.2
TOTAL ORGANIC HALOGEN	EPA 450.0
CALCIUM	EPA 215.1
COPPER	EPA 220.2
IRON	EPA 236.2
MAGNESIUM	EPA 242.1
MANGANESE	EPA 243.2
MERCURY	EPA 245.1
POTASSIUM	APHA 322B
SODIUM	APHA 325B
VANADIUM	EPA 286.2
ZINC	EPA 289.1

SUBMITTED BY:

Craig H Caldwell

PEDCO ENVIRONMENTAL INC
LABORATORY ANALYTICAL DATA

CLIENT: USEPA OFFICE OF SOLID WASTE
401 M ST., SW MD WH562
WASHINGTON, D.C. 20460

SAMPLE ID: PPG 08984-GM0

PEDCO NO : DL219

ATTENTION: MR WILLIAM MYERS

VOLATILES

PP#	CASH	UG/L
(2V)	107-02-8ACROLEIN	ND
(3V)	107-13-1ACRYLONITRILE	8.5
(4V)	71-43-2BENZENE	ND
(6V)	56-23-2CARBON TETRACHLORIDE	ND
(7V)	108-90-7CLOROBENZENE	ND
(10V)	107-06-21,2-DICHLOROETHANE	ND
(11V)	71-55-61,1,1-TRICHLOROETHANE	ND
(13V)	75-34-31,1-DICHLOROETHANE	ND
(14V)	79-00-51,1,2-TRICHLOROETHANE	11
(15V)	79-34-51,1,2,2-TETRACHLOROETHANE	ND
(16V)	75-00-3CHLOROETHANE	ND
(19V)	110-75-82-CHLOROETHYL VINYLETHER	ND
(23V)	67-66-3CHLOROFORM	ND
(29V)	75-35-41,1-DICHLOROETHENE	ND
(30V)	156-60-5TRANS-1,2-DICHLOROETHENE	ND
(32V)	78-87-51,2-DICHLOROPROPANE	ND
(33V)	10061-02-6TRANS-1,3-DICHLOROPROPENE	ND
	10061-01-05CIS-1,3-DICHLOROPROPENE	ND
(38V)	100-41-4ETHYLBENZENE	ND
(44V)	75-09-2METHYLENE CHLORIDE	ND
(45V)	74-87-3CHLOROMETHANE	ND
(46V)	74-83-9BROMOMETHANE	ND
(47V)	75-25-2BROMOFORM	ND
(48V)	75-27-4BROMODICHLOROMETHANE	ND
(49V)	75-69-4FLUOROTRICHLOROMETHANE	ND
	-	-
(51V)	124-48-1CHLORODIBROMOMETHANE	ND
(85V)	127-18-4TETRACHLOROETHENE	134
(86V)	108-88-3TOLUENE	ND
(87V)	79-01-6TRICHLOROETHENE	12.5
(88V)	75-01-4VINYL CHLORIDE	ND
	67-64-1ACETONE	25.3
	78-93-32-BUTANONE	6.8
	75-15-0CARBON DISULFIDE	ND
	519-78-62-HEXANONE	ND
	108-10-14-METHYL-2-PENTANONE	ND
	100-42-5STYRENE	ND
	108-05-4VINYL ACETATE	ND
	1330-20-7TOTAL XYLENES	ND

ND=NOT DETECTED (<2 UG/L)

PEDCO ENVIRONMENTAL INC
LABORATORY ANALYTICAL DATA

CLIENT: USEPA OFFICE OF SOLID WASTE
401 M ST., SW MD WH562
WASHINGTON, D.C. 20460

SAMPLE ID: PPG 08984-GM1

PEDCO NO : DL220

ATTENTION: MR WILLIAM MYERS

VOLATILES

PP#	CAS#	UG/L
(2V)	107-02-8ACROLEIN	ND
(3V)	107-13-1ACRYLONITRILE	ND
(4V)	71-43-2BENZENE	ND
(6V)	56-23-2CARBON TETRACHLORIDE	ND
(7V)	108-90-7CHLOROBENZENE	ND
(10V)	107-06-21,2-DICHLOROETHANE	ND
(11V)	71-55-61,1,1-TRICHLOROETHANE	ND
(13V)	75-34-31,1-DICHLOROETHANE	ND
(14V)	79-00-51,1,2-TRICHLOROETHANE	ND
(15V)	79-34-51,1,2,2-TETRACHLOROETHANE	ND
(16V)	75-00-3CHLOROETHANE	ND
(19V)	110-75-82-CHLOROETHYL VINYLETHER	ND
(23V)	67-66-3CHLOROFORM	ND
(29V)	75-35-41,1-DICHLOROETHENE	ND
(30V)	156-60-5TRANS-1,2-DICHLOROETHENE	ND
(32V)	78-87-51,2-DICHLOROPROPANE	ND
(33V)	10061-02-6TRANS-1,3-DICHLOROPROPENE	ND
	10061-01-05CIS-1,3-DICHLOROPROPENE	ND
(38V)	100-41-4ETHYLBENZENE	ND
(44V)	75-09-2METHYLENE CHLORIDE	6.1
(45V)	74-87-3CHLOROMETHANE	ND
(46V)	74-83-9BROMOMETHANE	ND
(47V)	75-25-2BROMOFORM	ND
(48V)	75-27-4BROMODICHLOROMETHANE	ND
(49V)	75-69-4FLUOROTRICHLOROMETHANE	ND
	-	-
(51V)	124-48-1CHLORODIBROMOMETHANE	ND
(85V)	127-18-4TETRACHLOROETHENE	ND
(86V)	108-88-3TOLUENE	ND
(87V)	79-01-6TRICHLOROETHENE	ND
(88V)	75-01-4VINYL CHLORIDE	ND
	67-64-1ACETONE	29.4
	78-93-32-BUTANONE	ND
	75-15-0CARBON DISULFIDE	ND
	519-78-62-HEXANONE	ND
	108-10-14-METHYL-2-PENTANONE	ND
	100-42-5STYRENE	ND
	108-05-4VINYL ACETATE	ND
	1330-20-7TOTAL XYLENES	ND

ND=NOT DETECTED (<2 UG/L)

PEDCO ENVIRONMENTAL INC
LABORATORY ANALYTICAL DATA

CLIENT: USEPA OFFICE OF SOLID WASTE
401 M ST., SW MD WH562
WASHINGTON, D.C. 20460

SAMPLE ID: PPG 08984-GM2

PEDCO NO : DL221

ATTENTION: MR WILLIAM MYERS

VOLATILES

PP#	CAS#	UG/L
(2V)	107-02-8ACROLEIN	ND
(3V)	107-13-1ACRYLONITRILE	ND
(4V)	71-43-2BENZENE	ND
(6V)	56-23-2CARBON TETRACHLORIDE	ND
(7V)	108-90-7CHLOROBENZENE	ND
(10V)	107-06-21,2-DICHLOROETHANE	ND
(11V)	71-55-61,1,1-TRICHLOROETHANE	ND
(13V)	75-34-31,1-DICHLOROETHANE	ND
(14V)	79-00-51,1,2-TRICHLOROETHANE	ND
(15V)	79-34-51,1,2,2-TETRACHLOROETHANE	ND
(16V)	75-00-3CHLOROETHANE	ND
(19V)	110-75-82-CHLOROETHYL VINYLETHER	ND
(23V)	67-66-3CHLOROFORM	ND
(29V)	75-35-41,1-DICHLOROETHENE	ND
(30V)	156-60-5TRANS-1,2-DICHLOROETHENE	ND
(32V)	78-87-51,2-DICHLOROPROPANE	ND
(33V)	10061-02-6TRANS-1,3-DICHLOROPROPENE	ND
	10061-01-0SCIS-1,3-DICHLOROPROPENE	ND
(38V)	100-41-4ETHYLBENZENE	ND
(44V)	75-09-2METHYLENE CHLORIDE	13.9
(45V)	74-87-3CHLOROMETHANE	ND
(46V)	74-83-9BROMOMETHANE	ND
(47V)	75-25-2BROMOFORM	ND
(48V)	75-27-4BROMODICHLOROMETHANE	ND
(49V)	75-69-4FLUOROTRICHLOROMETHANE	ND
	-	-
(51V)	124-48-1CHLORODIBROMOMETHANE	ND
(85V)	127-18-4TETRACHLOROETHENE	ND
(86V)	108-88-3TOLUENE	ND
(87V)	79-01-6TRICHLOROETHENE	ND
(88V)	75-01-4VINYL CHLORIDE	ND
	67-64-1ACETONE	34.5
	78-93-32-BUTANONE	ND
	75-15-0CARBON DISULFIDE	ND
	519-78-62-HEXANONE	ND
	108-10-14-METHYL-2-PENTANONE	ND
	100-42-5STYRENE	ND
	108-05-4VINYL ACETATE	ND
	1330-20-7TOTAL XYLENES	ND

ND=NOT DETECTED ((2 UG/L)

PEDCO ENVIRONMENTAL INC
LABORATORY ANALYTICAL DATA

CLIENT: USEPA OFFICE OF SOLID WASTE
401 M ST., SW MD WH562
WASHINGTON, D.C. 20460

SAMPLE ID: PPG 08984-GM5

PEDCO NO : DL222

ATTENTION: MR WILLIAM MYERS

VOLATILES

PP#	CAS#	UG/L
(2V)	107-02-8ACROLEIN	ND
(3V)	107-13-1ACRYLONITRILE	ND
(4V)	71-43-2BENZENE	ND
(6V)	56-23-2CARBON TETRACHLORIDE	ND
(7V)	108-90-7CLOROBENZENE	ND
(10V)	107-06-21,2-DICHLOROETHANE	ND
(11V)	71-55-61,1,1-TRICHLOROETHANE	ND
(13V)	75-34-31,1-DICHLOROETHANE	ND
(14V)	79-00-51,1,2-TRICHLOROETHANE	ND
(15V)	79-34-51,1,2,2-TETRACHLOROETHANE	ND
(16V)	75-00-3CHLOROETHANE	ND
(19V)	110-75-82-CHLOROETHYL VINYLETHER	ND
(23V)	67-66-3CHLOROFORM	ND
(29V)	75-35-41,1-DICHLOROETHENE	ND
(30V)	156-60-5TRANS-1,2-DICHLOROETHENE	ND
(32V)	78-87-51,2-DICHLOROPROPANE	ND
(33V)	10061-02-6TRANS-1,3-DICHLOROPROPENE	ND
	10061-01-05CIS-1,3-DICHLOROPROPENE	ND
(38V)	100-41-4ETHYLBENZENE	ND
(44V)	75-09-2METHYLENE CHLORIDE	ND
(45V)	74-87-3CHLOROMETHANE	ND
(46V)	74-83-9BROMOMETHANE	ND
(47V)	75-25-2BROMOFORM	ND
(48V)	75-27-4BROMODICHLOROMETHANE	ND
(49V)	75-69-4FLUOROTRICHLOROMETHANE	ND
	-	-
(51V)	124-48-1CHLORODIBROMOMETHANE	ND
(85V)	127-18-4TETRACHLOROETHENE	ND
(86V)	108-88-3TOLUENE	ND
(87V)	79-01-6TRICHLOROETHENE	ND
(88V)	75-01-4VINYL CHLORIDE	ND
	67-64-1ACETONE	14
	78-93-32-BUTANONE	ND
	75-15-0CARBON DISULFIDE	ND
	519-78-62-HEXANONE	ND
	108-10-14-METHYL-2-PENTANONE	ND
	100-42-5STYRENE	ND
	108-05-4VINYL ACETATE	ND
	1330-20-7TOTAL XYLENES	ND

ND=NOT DETECTED (<2 UG/L)

PEDCO ENVIRONMENTAL INC
LABORATORY ANALYTICAL DATA

CLIENT: USEPA OFFICE OF SOLID WASTE
401 M ST., SW MD WH562
WASHINGTON, D.C. 20460

SAMPLE ID: PPG 08984-GM6

PEDCO NO : DL223

ATTENTION: MR WILLIAM MYERS

VOLATILES

PP#	CAS#	UG/L
(2V)	107-02-8ACROLEIN	ND
(3V)	107-13-1ACRYLONITRILE	ND
(4V)	71-43-2BENZENE	ND
(6V)	56-23-2CARBON TETRACHLORIDE	ND
(7V)	108-90-7CHLOROBENZENE	ND
(10V)	107-06-21,2-DICHLOROETHANE	ND
(11V)	71-55-61,1,1-TRICHLOROETHANE	ND
(13V)	75-34-31,1-DICHLOROETHANE	ND
(14V)	79-00-51,1,2-TRICHLOROETHANE	ND
(15V)	79-34-51,1,2,2-TETRACHLOROETHANE	ND
(16V)	75-00-3CHLOROETHANE	ND
(19V)	110-75-82-CHLOROETHYL VINYLETHER	ND
(23V)	67-66-3CHLOROFORM	ND
(29V)	75-35-41,1-DICHLOROETHENE	ND
(30V)	156-60-5TRANS-1,2-DICHLOROETHENE	ND
(32V)	78-87-51,2-DICHLOROPROPANE	ND
(33V)	10061-02-6TRANS-1,3-DICHLOROPROPENE	ND
	10061-01-05CIS-1,3-DICHLOROPROPENE	ND
(38V)	100-41-4ETHYLBENZENE	ND
(44V)	75-09-2METHYLENE CHLORIDE	11.7
(45V)	74-87-3CHLOROMETHANE	ND
(46V)	74-83-9BROMOMETHANE	ND
(47V)	75-25-2BROMOFORM	ND
(48V)	75-27-4BROMODICHLOROMETHANE	ND
(49V)	75-69-4FLUOROTRICHLOROMETHANE	ND
	-	-
(51V)	124-48-1CHLORODIBROMOMETHANE	ND
(85V)	127-18-4TETRACHLOROETHENE	ND
(86V)	108-88-3TOLUENE	ND
(87V)	79-01-6TRICHLOROETHENE	ND
(88V)	75-01-4VINYL CHLORIDE	ND
	67-64-1ACETONE	9
	78-93-32-BUTANONE	ND
	75-15-0CARBON DISULFIDE	ND
	519-78-62-HEXANONE	ND
	108-10-14-METHYL-2-PENTANONE	ND
	100-42-5STYRENE	ND
	108-05-4VINYL ACETATE	ND
	1330-20-7TOTAL XYLENES	ND

ND=NOT DETECTED (<2 UG/L)

PEDCO ENVIRONMENTAL INC
LABORATORY ANALYTICAL DATA

CLIENT: USEPA OFFICE OF SOLID WASTE
401 M ST., SW MD WH562
WASHINGTON, D.C. 20460

SAMPLE ID: PPG 08984-GM7

PEDCO NO : DL224

ATTENTION: MR WILLIAM MYERS

VOLATILES

PP#	CAS#	UG/L
(2V)	107-02-8ACROLEIN	ND
(3V)	107-13-1ACRYLONITRILE	ND
(4V)	71-43-2BENZENE	ND
(6V)	56-23-2CARBON TETRACHLORIDE	ND
(7V)	108-90-7CHLOROBENZENE	ND
(10V)	107-06-21,2-DICHLOROETHANE	ND
(11V)	71-55-61,1,1-TRICHLOROETHANE	ND
(13V)	75-34-31,1-DICHLOROETHANE	ND
(14V)	79-00-51,1,2-TRICHLOROETHANE	ND
(15V)	79-34-51,1,2,2-TETRACHLOROETHANE	ND
(16V)	75-00-3CHLOROETHANE	ND
(19V)	110-75-82-CHLOROETHYL VINYLETHYR	ND
(23V)	67-66-3CHLOROFORM	ND
(29V)	75-35-41,1-DICHLOROETHENE	ND
(30V)	156-60-5TRANS-1,2-DICHLOROETHENE	ND
(32V)	78-87-51,2-DICHLOROPROPANE	ND
(33V)	10061-02-6TRANS-1,3-DICHLOROPROPENE	ND
	10061-01-05CIS-1,3-DICHLOROPROPENE	ND
(38V)	100-41-4ETHYLBENZENE	ND
(44V)	75-09-2METHYLENE CHLORIDE	10.4
(45V)	74-87-3CHLOROMETHANE	ND
(46V)	74-83-9BROMOMETHANE	ND
(47V)	75-25-2BROMOFORM	ND
(48V)	75-27-4BROMODICHLOROMETHANE	ND
(49V)	75-69-4FLUOROTRICHLOROMETHANE	ND
(51V)	124-48-1CHLORODIBROMOMETHANE	ND
(85V)	127-18-4TETRACHLOROETHENE	ND
(86V)	108-88-3TOLUENE	ND
(87V)	79-01-6TRICHLOROETHENE	ND
(88V)	75-01-4VINYL CHLORIDE	ND
	67-64-1ACETONE	6.8
	78-93-32-BUTANONE	ND
	75-15-0CARBON DISULFIDE	ND
	519-78-62-HEXANONE	ND
	108-10-14-METHYL-2-PENTANONE	ND
	100-42-5STYRENE	ND
	108-05-4VINYL ACETATE	ND
	1330-20-7TOTAL XYLENES	ND

ND=NOT DETECTED (<2 UG/L)

28610



STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

Division of Water Resources
1201 Greenbrier Street
Charleston, WV 25311
(304) 348-5935

JOHN D. ROCKEFELLER IV
Governor

WILLIS H. HERTIG, JR.
Director

RONALD R. POTESTA
Deputy Director

CERTIFIED MAIL --
RETURN RECEIPT REQUESTED

June 15, 1984

Mr. Warren E. Dean
PPG Industries, Inc.
Natrium Plant
P. O. Box 191
New Martinsville, West Virginia 26155

WVD 00 433 6343

RCRA COMPLIANCE SECTION
RECEIVED
JUN 21 1984
RCRA COMPLIANCE SECTION
RECEIVED
JUN 21 1984

Dear Mr. Dean:

On February 17, 1984 the Chief of the Division of Water Resources requested, pursuant to Sections 6.04.02(a) and (b), and 6.04.04 of the West Virginia Administrative Regulations, Series XV, submission of a report detailing the hazardous waste activities engaged in during calendar year 1983. Specifically, you were requested to complete and submit the appropriate federal report forms and to provide certain additional information.

From our review of the materials submitted, we have determined that the additional information requested by the Chief has not been provided, and that the federal facility and generator report forms have not been certified with the required signature. Therefore, the following violations have been determined concerning these reports:

1. The facility has not submitted the additional information requested by the Chief, as required by Section 6.04.04 of the West Virginia Administrative Regulations, Series XV.

Mr. Warren E. Dea
June 15, 1984
Page 2


2. The facility did not submit a facility and a generator Annual Report in accordance with the appropriate instructions, as required by Section 6.04.02 of the West Virginia Administrative Regulations, Series XV.

This letter will serve as a NOTICE OF NON-COMPLIANCE of the provisions of Chapter 20, Article 5E of the Code of West Virginia. You are requested to submit the required information and supply another copy of the federal report forms with the appropriate signature, within ten (10) days of receipt of this letter.

For your information, copies of this letter will be forwarded to the United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Enclosed are copies of the generator and the facility Annual Report, which requires the appropriate signature on it. Should you have any questions regarding this matter, do not hesitate to contact me.

Sincerely,

DIVISION OF WATER RESOURCES



Mark N. Casdorph
Enforcement Section
Hazardous Waste/Ground
Water Section

MNC/bdd
Enclosure
cc: ~~Don~~ Doug Donor, EPA, Region III

WVR 00 433 6343

2861



RECEIVED
NATRIUM PLANT
INDUSTRIAL CHEMICAL DIVISION

JUL 17 1984

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

Natrium Plant
Industrial Chemical Division

May 21, 1984

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

✓ Regional Administrator
U.S. EPA, Region III
Sixth & Walnut Streets
Philadelphia, PA 19106

Mr. D. W. Robinson, Chief
Division of Water Resources
Department of Natural Resources
Charleston, WV 25311

Gentlemen:

The first 1984 semiannual sampling of the groundwater monitoring wells at the Natrium mercury impoundment facility for the groundwater contamination indicator parameters was performed as required by 40 CFR 265.92 (d)(2). The arithmetic mean and variance were calculated for each well and compared to the 1982 reference well arithmetic mean to determine any statistically significant increase (and decrease in the case of pH) as required in 40 CFR 265.93 (b) for Federal EPA reporting (see Table I).

The same calculations were made for each well and compared to current data for the reference well as required by W. Va. Regulation DNR 20-5E, Series XV, for State reporting (see Table II).

In addition, the samples were analyzed for annual groundwater quality parameters and the additional special parameter mercury (see Table III).

Notification is hereby given as required by 40 CFR 265.93 (d)(1) and State Regulation DNR 20-5E, Series XV, that according to this evaluation, the specific conductance and TOC values for each 1984 downgradient well show a statistically significant increase when compared to the 1982 data or the current data for the background well (GM-0).

Resampling was not performed on these parameters since the groundwater quality assessment program interpretations presented in the December 22, 1983, assessment letter by Geraghty & Miller indicated that these higher-than-background specific conductance and TOC levels are not due to the mercury surface impoundment, but rather due to external influences.

RECEIVED

JUL 9 1984

EPA, REGION III
OFFICE OF REGIONAL ADMINISTRATOR

Regional Administrator, U.S. EPA, Region III
and
Mr. D. W. Robinson, Chief, DWR

May 17, 1984
Page 2

The value for TOX for GM-6 versus GM-0 1982 showed a significant increase for the same reason. When compared against the current GM-0 data, no significant difference occurred.

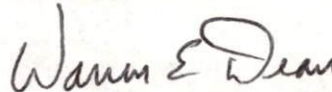
EPA Region III filed a RCRA Complaint Docket No. RCRA III 096 against PPG on March 2, 1984, alleging monitoring system and procedural requirements deficiencies.

A settlement conference was held April 2 in Philadelphia, Pa., EPA headquarters and subsequently (May 2, 1984) PPG submitted information to address agency concerns and proposed a program which, if accepted by the State DNR and the EPA, would obviate the need for a formal hearing.

We are presently awaiting the scheduling of a second conference to discuss our proposal and reach a settlement.

Sincerely yours,

PPG INDUSTRIES, INC.
Natrium Plant



Warren E. Dean
Technical Manager

WED/egm

Enclosures

cc: Robert L. Jelacic, DNR
Douglas Donor, EPA
Ralph Siskind, EPA

FIRST 1984 SEMIANNUAL WELL SAMPLING DATA VERSUS 1982 BACKGROUND WELL

¹ Statistically significant increase (or pH decrease) according to 40 CFR 265.93 (b).

¹ Statistically significant increase (or pH decrease) according to 40 CFR 265.93 (b).

TABLE II

FIRST 1984 SEMI-ANNUAL WELL SAMPLING DATA VERSUS CURRENT BACKGROUND WELL

FIRST 1984 SEMI-ANNUAL WELL SAMPLING RESULTS				
Parameter	GM-0 BACKGROUND WELL		GM-1 DOWNGRADIENT SAMPLE	
	Variance	Mean	Variance	Mean
pH	.003	6.95	0	7.1
Spec. Cond. μmho	34.92	704	966.7	1,165
TOC mg/l	1.92	9.45	6.34	27.58
TOX $\mu\text{g/l}$	25.0	82.5	0	20.0
				SSI ¹
				No
				Yes
				Yes
				No
Parameter	GM-2 DOWNGRADIENT SAMPLE		GM-6 DOWNGRADIENT SAMPLE	
	Variance	Mean	Variance	Mean
pH	.003	7.075	0	7.075
Spec. Cond.	91.67	1,412.5	91.67	1,412.5
TOC	3.063	14.28	3.063	14.28
TOX	0	20.0	0	20.0
				SSI ¹
				No
				Yes
				Yes
				No
Parameter	GM-6 DOWNGRADIENT SAMPLE		GM-6 DOWNGRADIENT SAMPLE	
	Variance	Mean	Variance	Mean
pH	.003	6.975	0	6.975
Spec. Cond.	25	1,127.5	25	1,127.5
TOC	.003	5.125	.003	5.125
TOX	25	67.5	25	67.5
				SSI ¹
				No
				Yes
				No
				No

¹ Statistically significant increase (or pH decrease) according to DNR 20-5E, Series XV.

TABLE III

1984 ANNUAL WELL SAMPLING DATA
FOR GROUNDWATER QUALITY PARAMETERS
AND SPECIAL PARAMETER MERCURY

	<u>GM-0</u>	<u>GM-1</u>	<u>GM-2</u>	<u>GM-6</u>
Cl mg/l	22	18	79	61
SO ₄ mg/l	35	3	5	71
Fe mg/l	<0.1	0.1	0.1	<0.1
Mn mg/l	<0.01	0.91	1.34	0.25
Na mg/l	13.2	119.0	171.0	91.6
Phenol mg/l	0.007	0.008	Insuf. Sample	Insuf. Sample
Hg µg/l	0.2	0.2	0.6	1.0

2863



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

5/11/84

Mr. Edwin L. Hockman, Jr.
Permits Section
Hazardous Waste/Ground Water Branch
West Virginia Department of Natural Resources
1201 Greenbrier Street
Charleston, West Virginia 25311

Dear Bob:

As you requested, I am sending you the ground water contour maps I constructed based on PPG's first year quarterly sampling and their second year semi-annual sampling (Table III). The method I used for the ground water contouring is summarized in the RCRA Part B Permits Workbook Section 8.3.5 which is also enclosed.

Based on these contour maps and the geologic cross-sections, I concluded that the best location for an upgradient well is north of the impoundment. Evaluating the ground water contours and corresponding flow lines indicates that the GM-6 well is not directly downgradient of the mercury impoundment, therefore samples from this well may be indicative of the background ground water quality. Comparing the average results of water quality analysis conducted during the 1982 detection monitoring at the PPG mercury pond for GM-6 with the averaged analytical results for GM-2 (directly downgradient well) shows increased levels for SC, TOX, TDS, Total Alk., HCO₃, Cl, Na, Ca, Mg, Fe, Mn and Na/Cl ratio, with a decrease in PH, TOC, SO₄ and Hg. It should be noted that the TOC level in the mercury pond is also lower than the levels in GM-6.

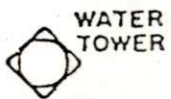
If you have any questions about any of this information feel free to call me at 215-597-2745. I will see you and Rick Melvin at the N.W.W.A. Conference in Columbus Ohio later this month.

Sincerely,

A handwritten signature in cursive script that reads "Kenneth McGill".

Kenneth McGill, P.G.
RCRA Enforcement Section

8 Enclosures



WATER
TOWER

MERCURY
POND

622.0
624.3

GM-6

GM-2

620.3

613.0

GM-1

612.7

615

620

Second Semi Annual 1983
Second SA re sample 1983

WEST VIRGINIA STATE ROUTE 2

GUARD
HOUSE

PARKING AREA



0 50 100 200 Feet

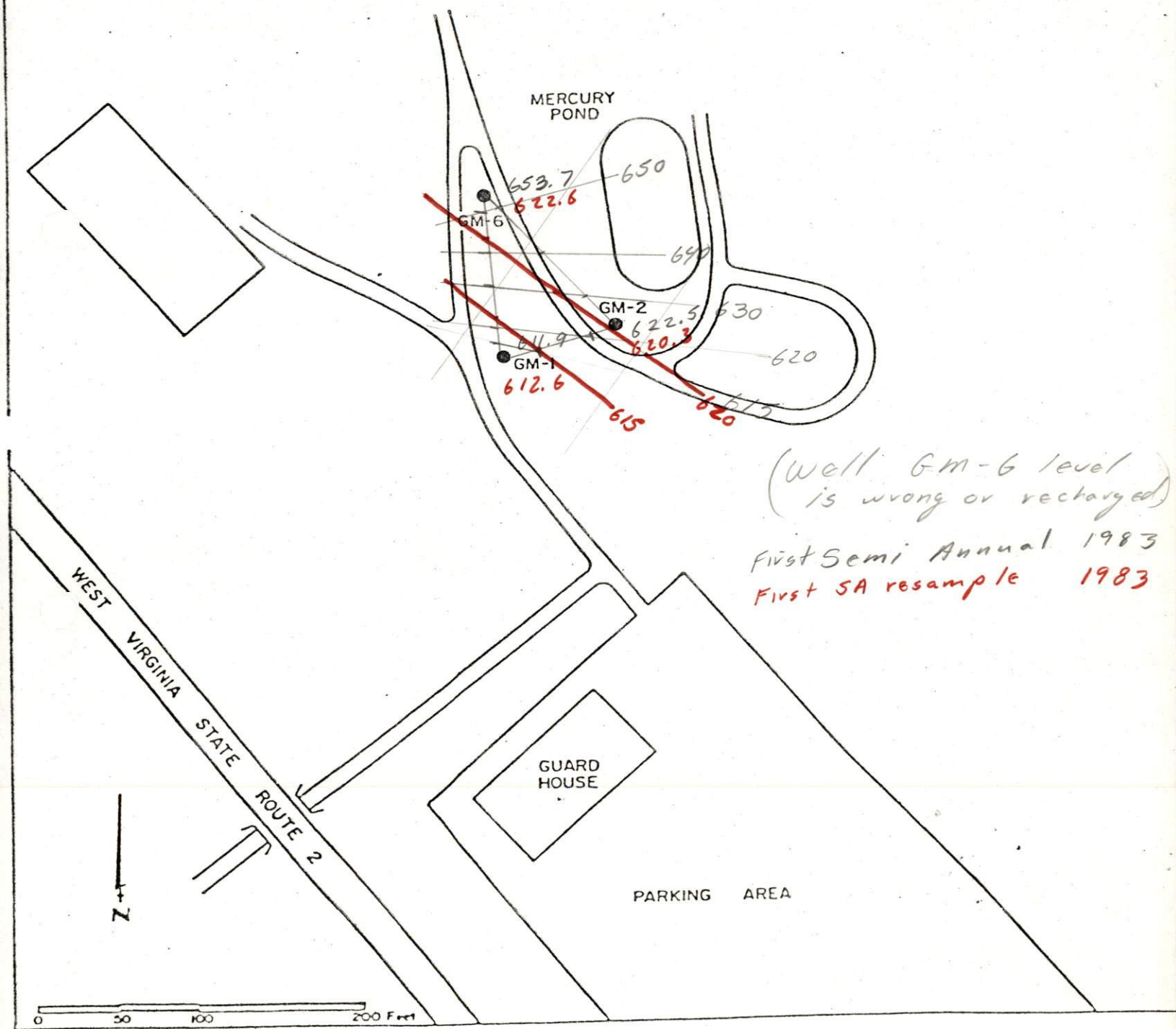
EXPLANATION

● GM-2 Monitor well and number

FIGURE 5, MONITOR WELL LOCATION MAP



WATER
TOWER

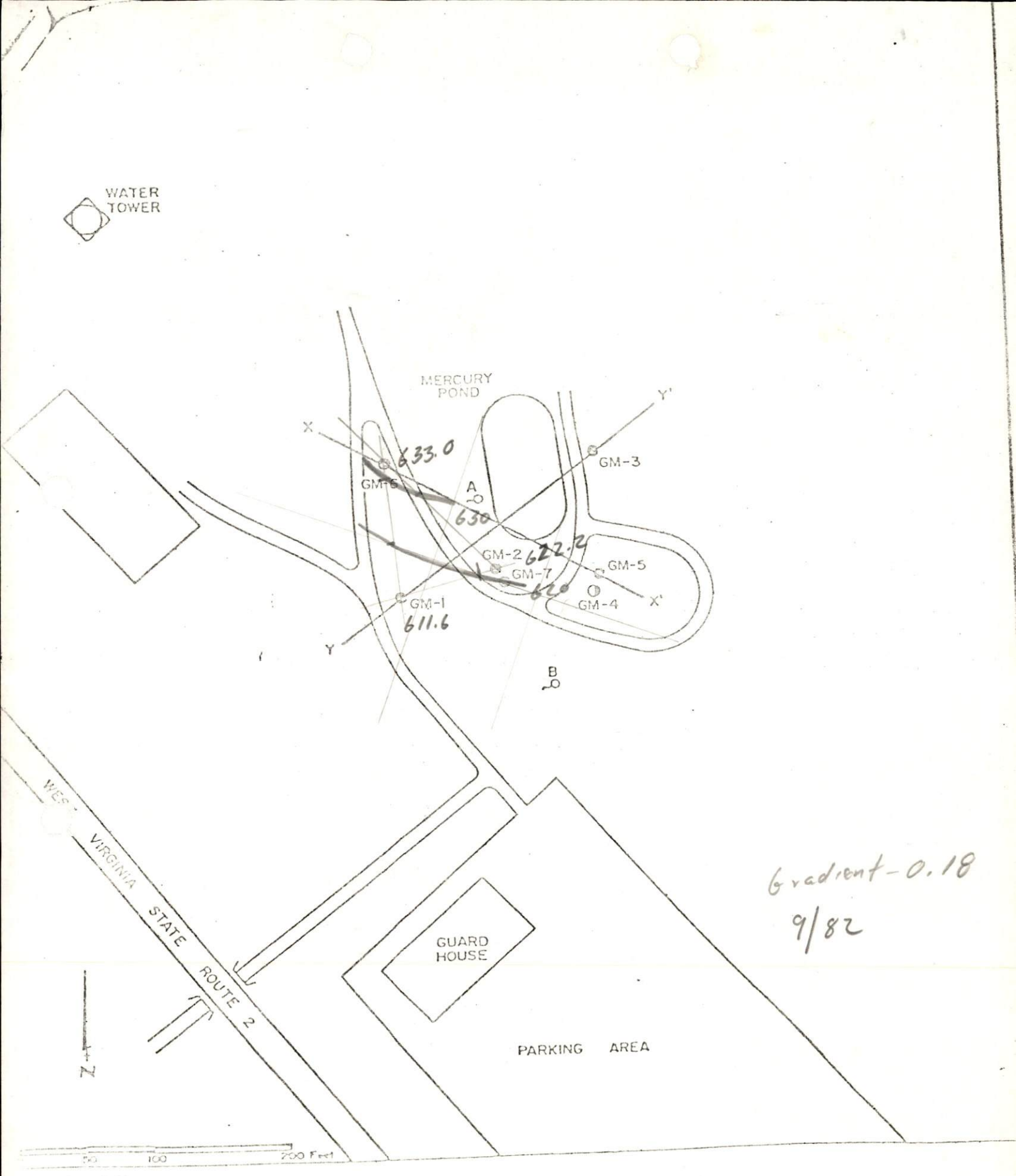


(Well GM-6 level
is wrong or recharged)
First Semi Annual 1983
First SA resample 1983

EXPLANATION

● GM-2 Monitor well and number

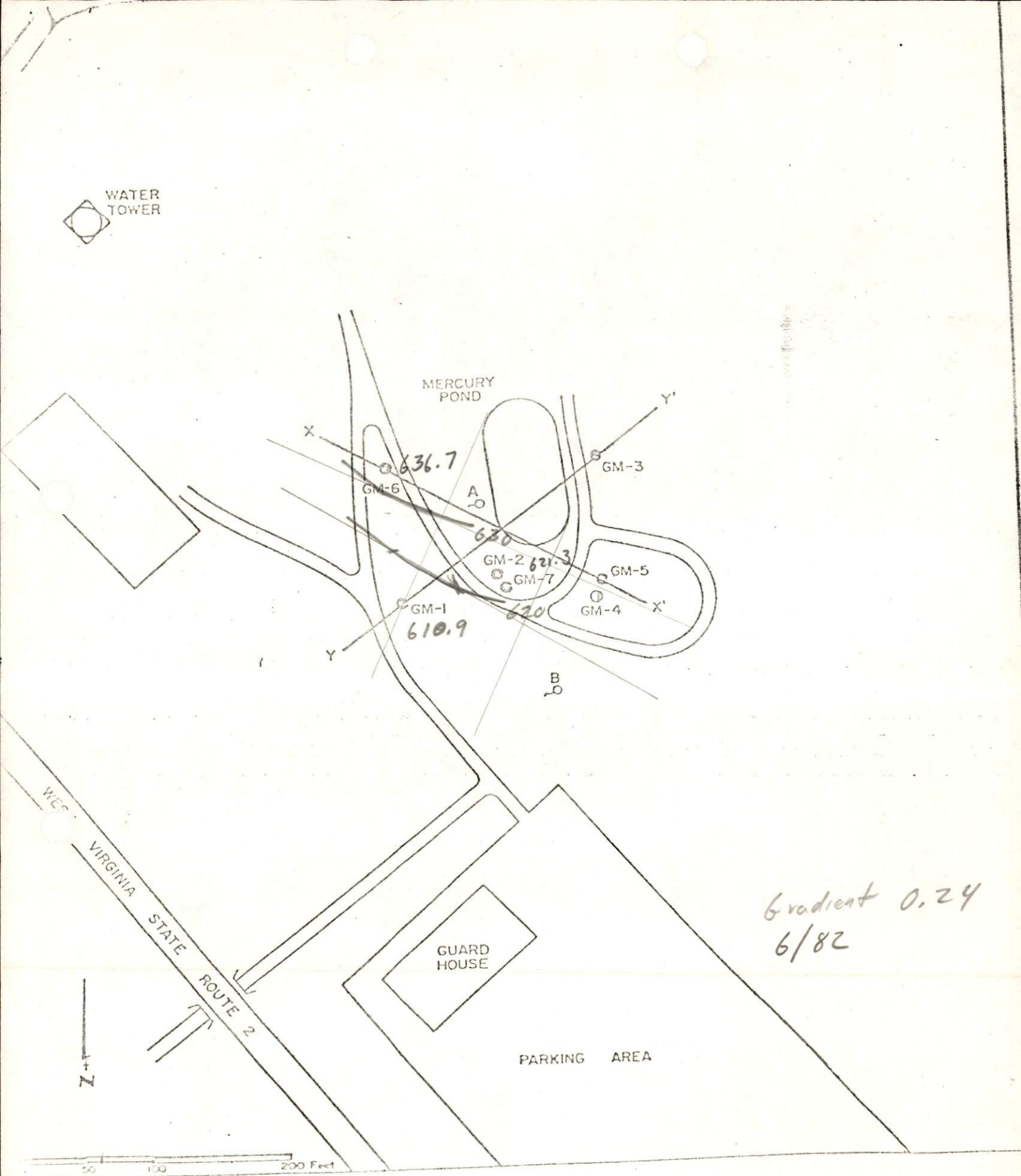
FIGURE 5, MONITOR WELL LOCATION MAP



EXPLANATION

- | | | | |
|--------|-------------------------|------|--------------------------------|
| ○ GM-3 | Monitor well and number | ○ A | Ground-water seep |
| ⊙ GM-4 | Borehole and number | X—X' | Line of geologic cross section |

Figure 3, Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.



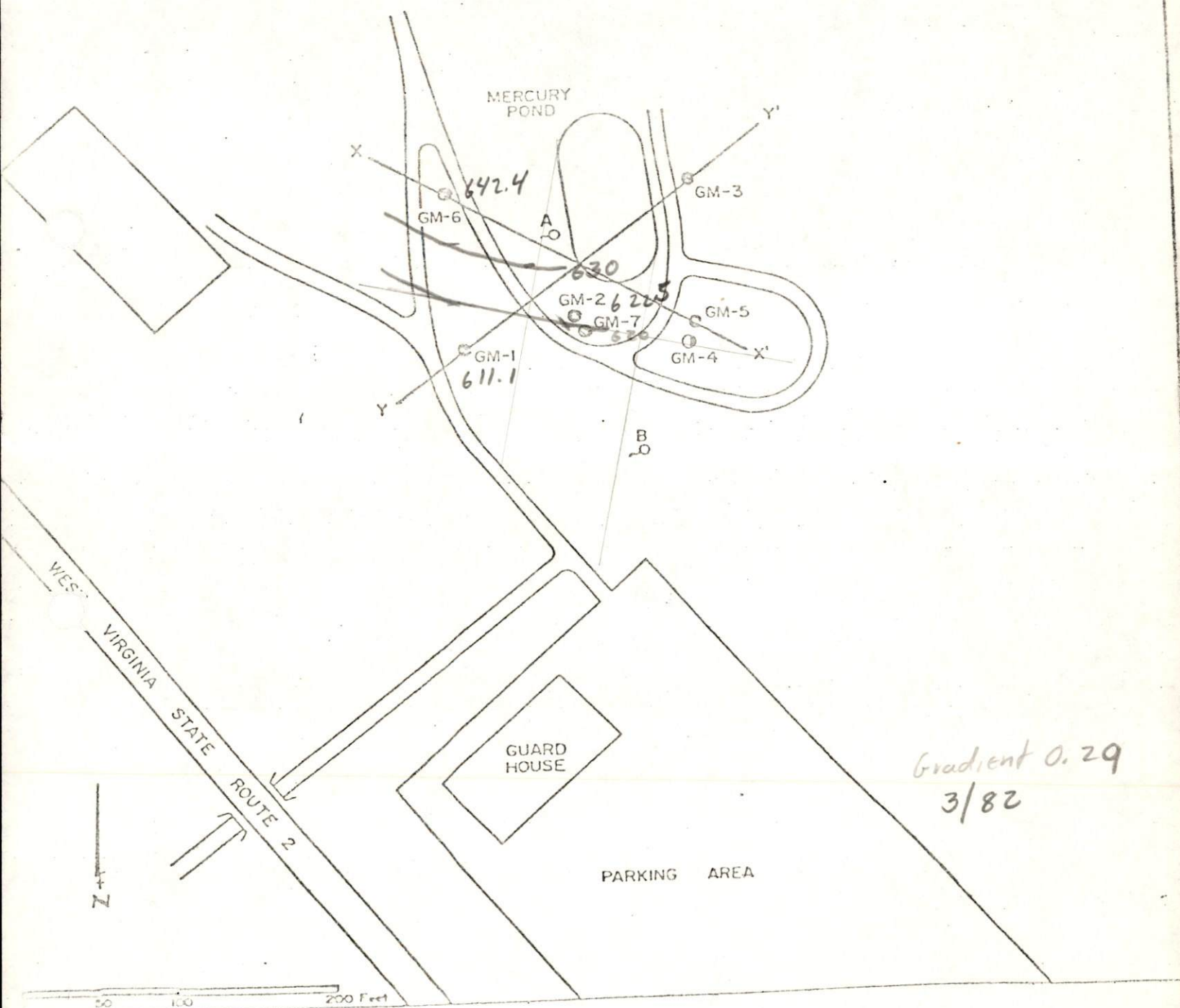
EXPLANATION

- | | | | |
|--------|-------------------------|------|--------------------------------|
| ○ GM-3 | Monitor well and number | —○A | Ground-water seep |
| ⊙ GM-4 | Borehole and number | X—X' | Line of geologic cross section |

Figure 3, Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.



WATER
TOWER



EXPLANATION

- GM-3 Monitor well and number
- GM-4 Borehole and number

- OA Ground-water seep
- X—X' Line of geologic cross section

Figure 3, Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.

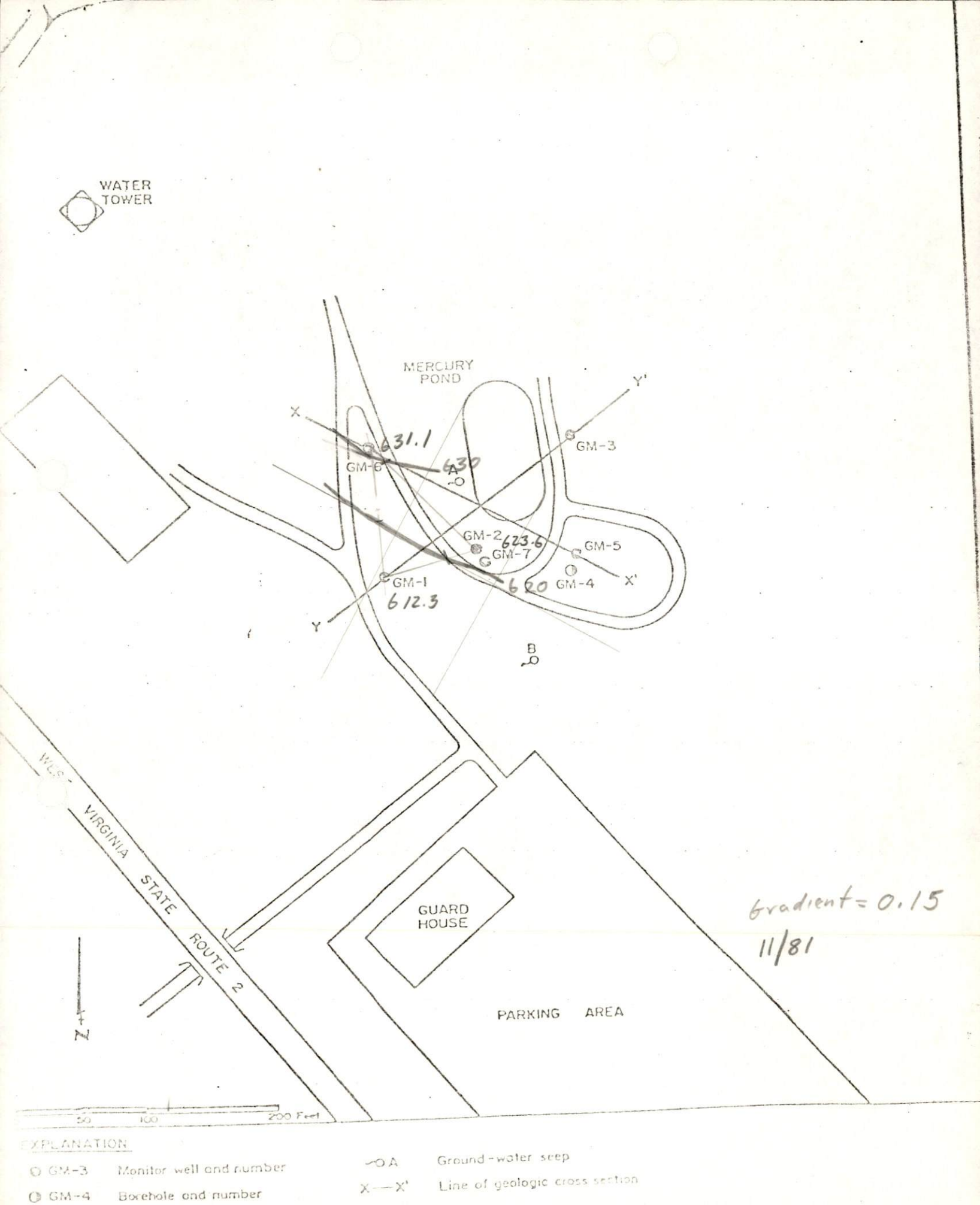
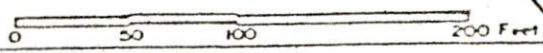
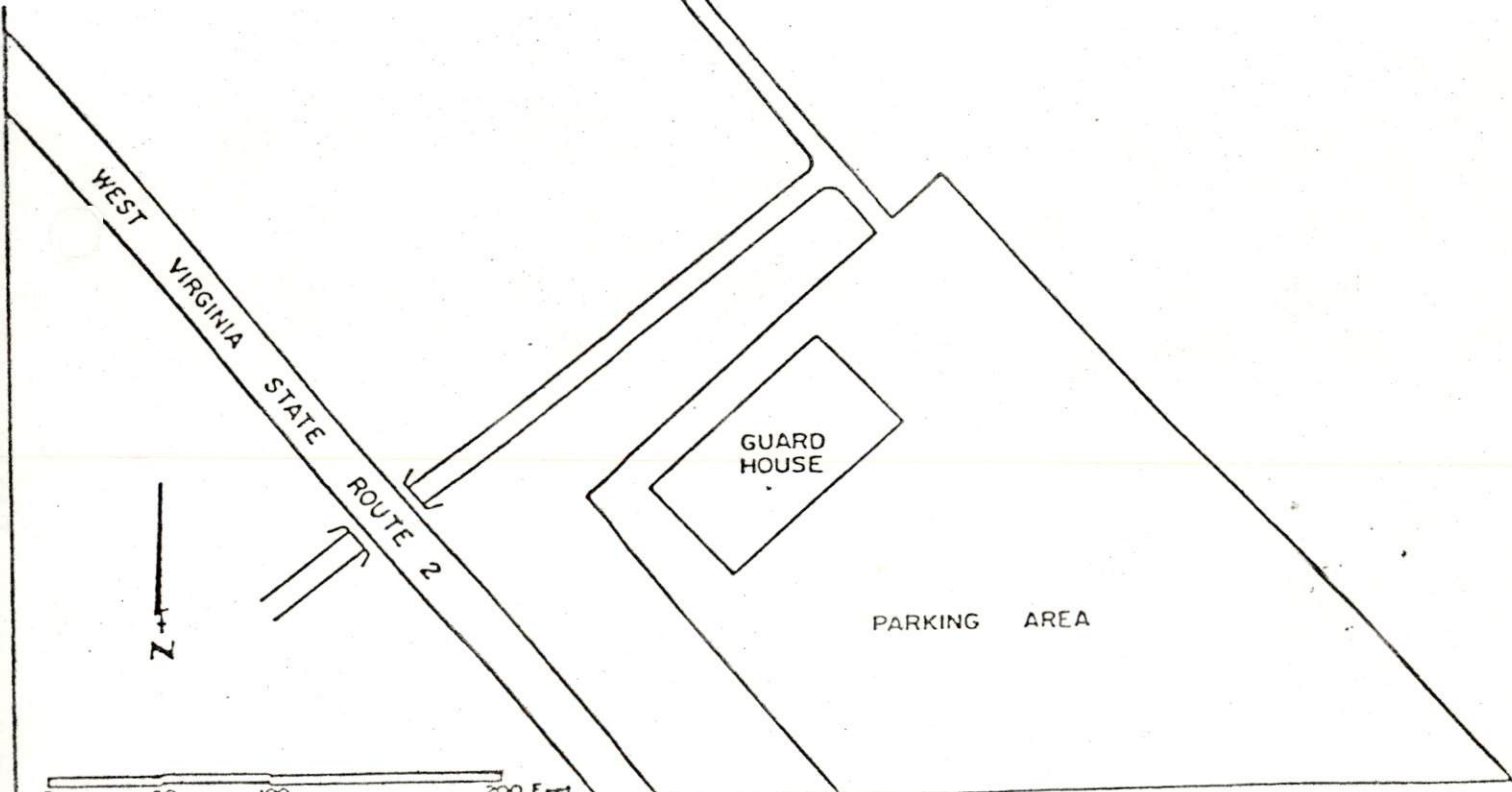
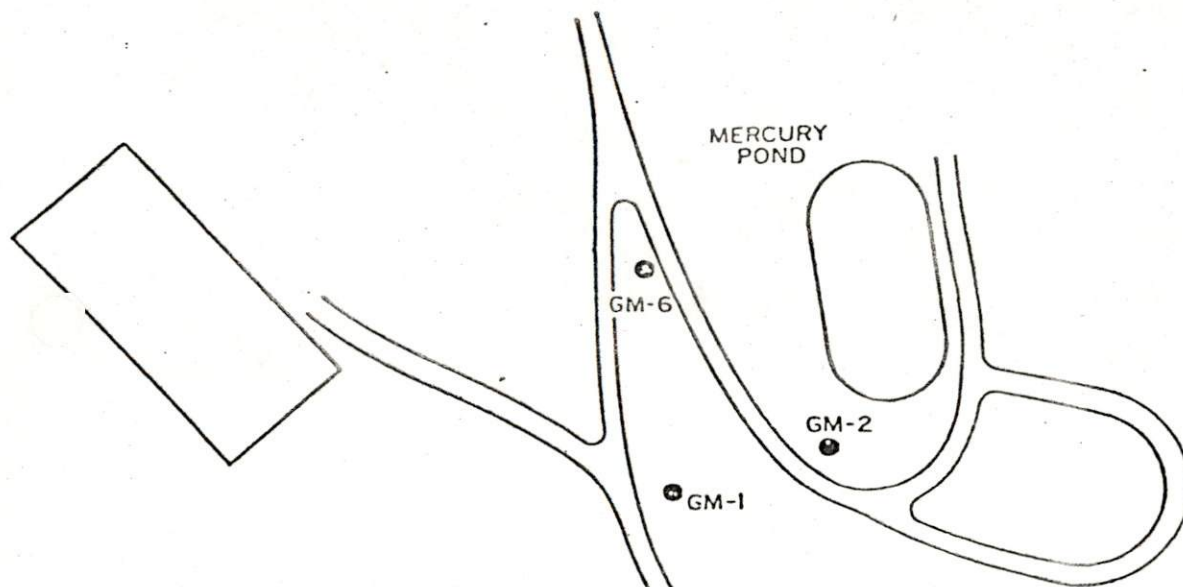


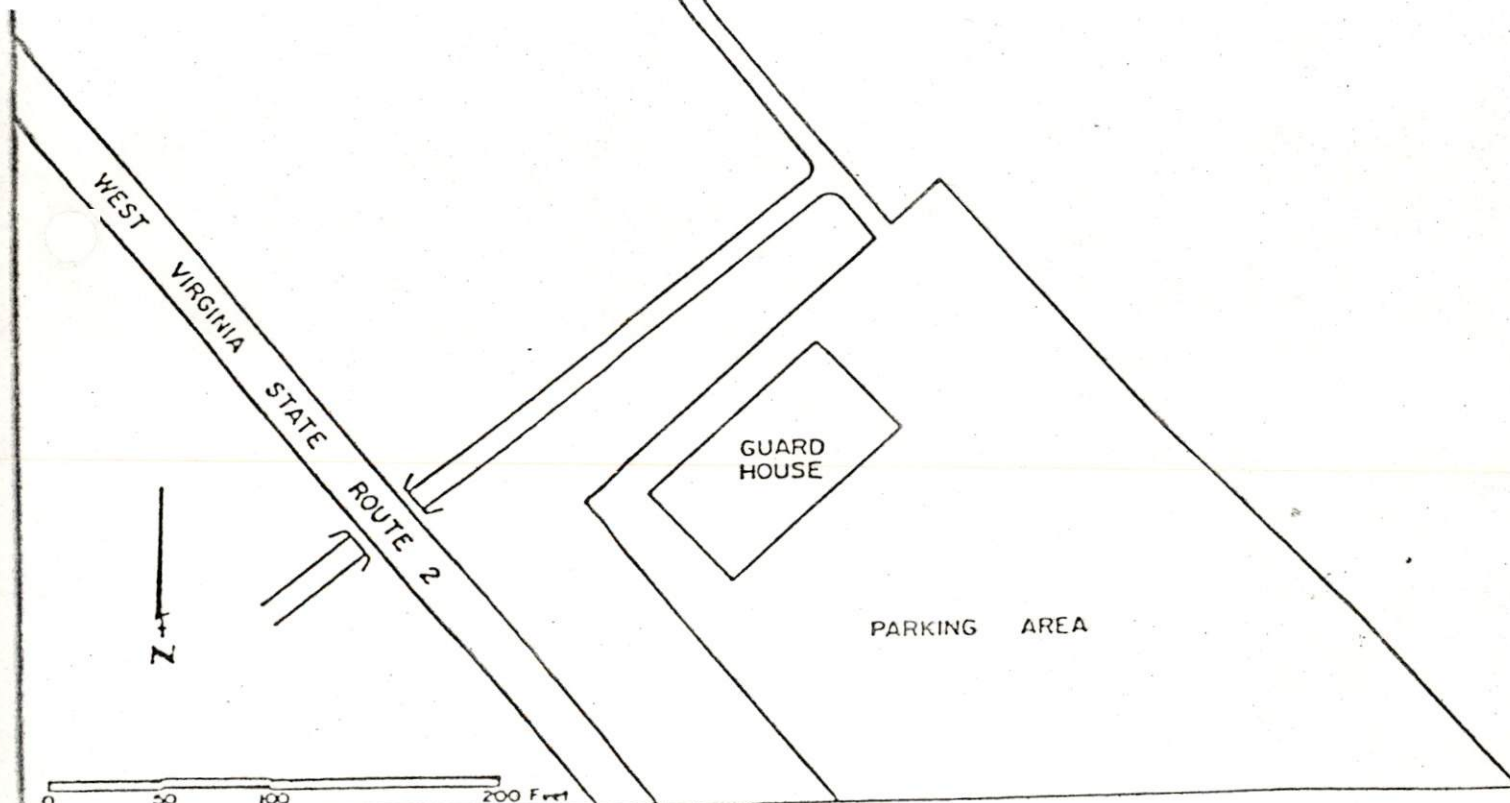
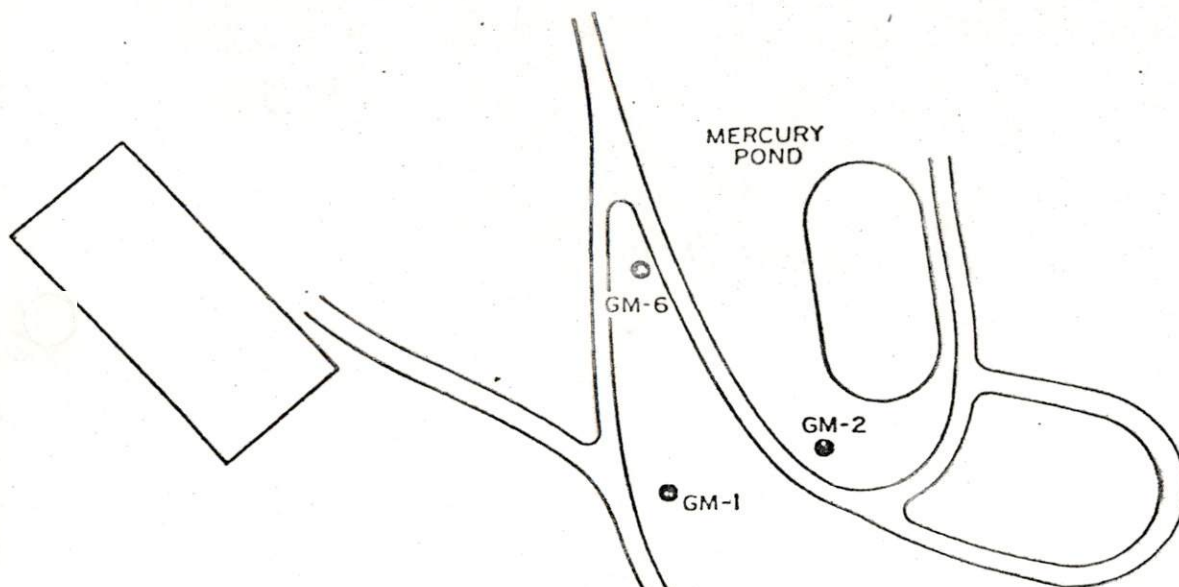
Figure 3, Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.



EXPLANATION

— ● GM-2 Monitor well and number

FIGURE 5, MONITOR WELL LOCATION MAP



0 50 100 200 Feet

EXPLANATION

— ● GM-2 Monitor well and number

FIGURE 5, MONITOR WELL LOCATION MAP

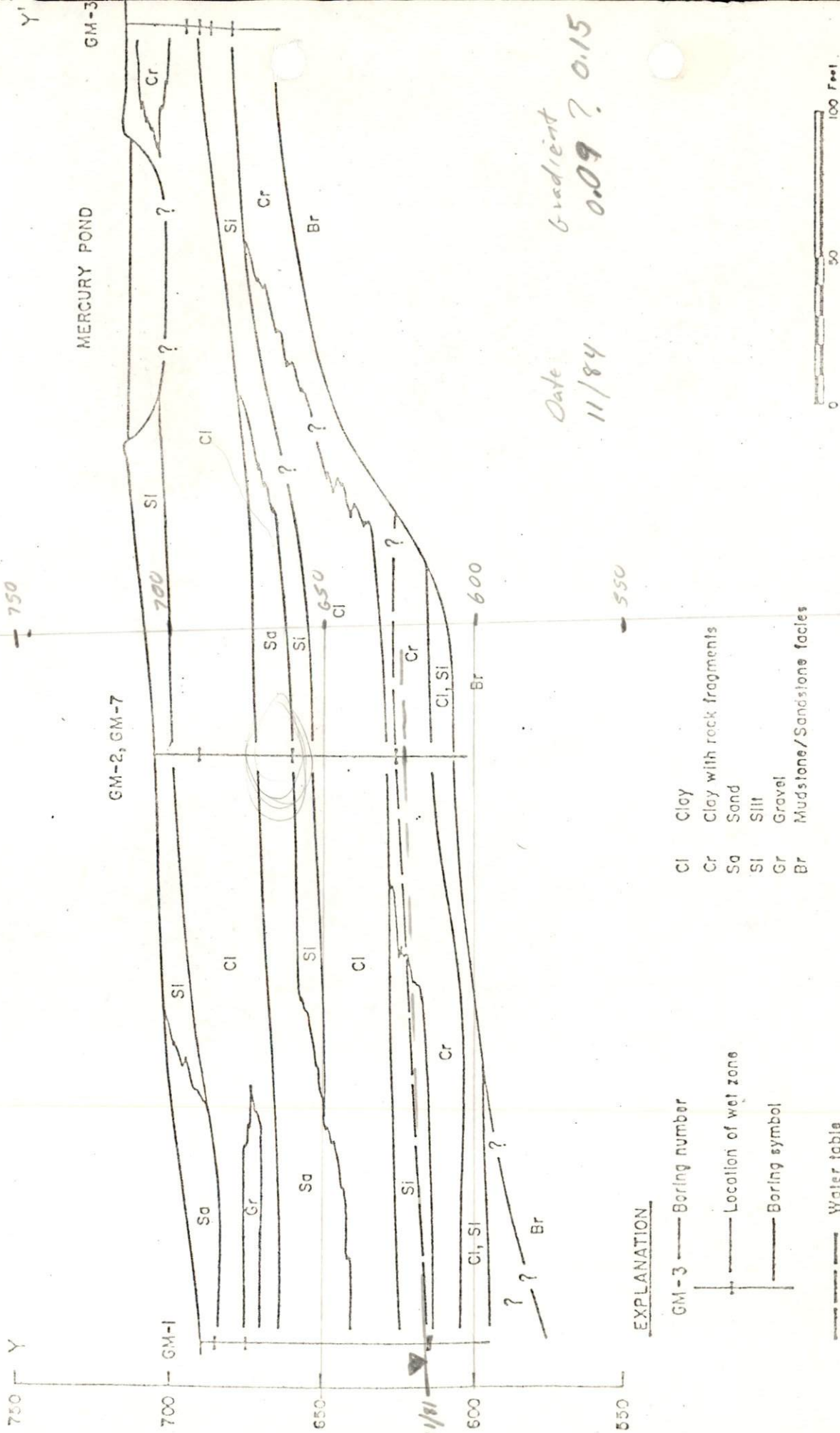
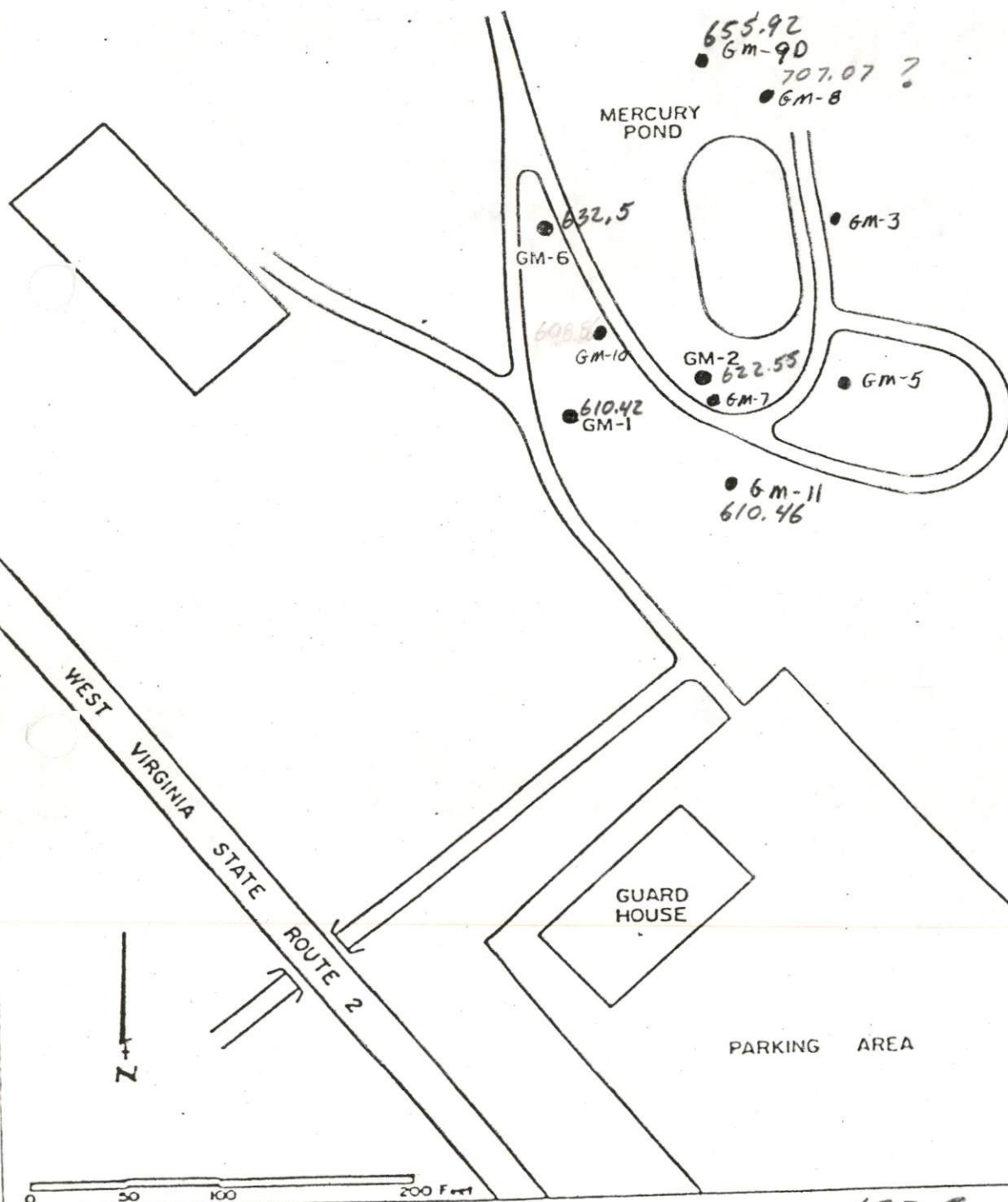


Figure 4, Geologic Cross Section (Y-Y'), PPG, Natrium, West Virginia.



WATER
TOWER



EXPLANATION

— ● GM-2 Monitor well and number

632.5 water levels
deep wells Oct 3, 4, 1985

FIGURE 5, MONITOR WELL LOCATION MAP



WUP 00 433 6343

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

Natrium Plant
Industrial Chemical Division - U.S.

May 8, 1984

RECEIVED

MAY 10 1984

Mr. William Myers
U.S. EPA, WH 562
401 M Street, SW
Washington, DC 20460

Dear Mr. Myers:

In an effort to supply information helpful for your study, I hope the attached will furnish the answers to your questions on the Natrium mercury impoundment RCRA site.

Several documents have been prepared for operation of the site by Geraghty & Miller. The following have been furnished in full to Region III office:

1. Evaluation of Groundwater Quality Impacts at Mercury Pond
2. Groundwater Assessment Plan Outline at Mercury Pond
3. Sampling and Analysis Plan for the Mercury Pond

Excerpts are included in this letter which should answer your questions. The information may not be in the same order as the questions, unfortunately, but was sent in this form for ease of reading.

Sincerely,

A handwritten signature in cursive script that reads 'Kenneth S. Walborn'.

Kenneth S. Walborn
Manager, Environmental Control

KSW/egm

Enclosures

cc: ✓ Douglas A. Donor, EPA, Philadelphia

Background Information

1. Yes, well logs are available for monitoring wells attached. Water table levels were checked, but to my knowledge no other checks were made.
2. See attached information.
3. See attached information.
4. See attached information.
5. Attached first year's annual and quarterly reports.
6. Two analyses of the mercury pond water are attached.
7. A liner was installed in 1971, and flow of mercury contaminated water was started to the impoundment.

The pond was cleaned in 1978. A layer of bentonite clay was placed on top of the original liner, and a second 30 HP flex seal liner was installed on top.

8. No.
9. Yes, there are production wells in the plant to furnish cooling and process water. These wells range from 1,000' to 2,000' from the site between the site and the Ohio River. The total pumping rate is approximately 5 million gallons/day. These pumps drop groundwater level approximately 10' to 15' below the normal river level and 2' to 30' below normal levels in the monitoring wells.
10. No.
11. During periods of heavy rain, some surface water will run in the ditches around the impoundment. None enters the impoundment. Some recharge to the groundwater would be expected, but no major flows have been found. No groundwater discharges to surface water in the area.
12. Flows from the pond and the level in the pond are monitored.
13. No.

RECEIVED
MAY 10 1984

L

Well Construction

1. See attached information.
2. Yes - G & M Geologist - analysis attached.
3. It was indicated that Auger flights were washed prior to drilling at each location to avoid cross-contamination. Drilling was completed without adding fluid to the bore hole.
4. Casing 2" PVC. Screen .0008 inch slot PVC.
5. None indicated - one piece construction.
6. 10' screened depth - shown in Figure 3 attached.
7. PVC slotted 2" diameter pipe .0008" slots.
- 8-12. See attached information.

Well Evacuation Procedures

1. Tole Devices sampling pump with silicone bladder. Nitrogen squeeze pump. No contact between water and nitrogen.

Tole Devices Company
Post Office Box 456
New Albany, IN 47150

2. Pump recommended by Geraghty & Miller. Same sample person each time.
3. Two to five days.
4. No.
5. Wells are pumped dry and allowed to refill.
6. 12" from bottom
7. Yes.
8. Directed to ground down slope from well head.
9. No.
10. Yes.
11. Varies; some yes, some no.

Sampling Procedures

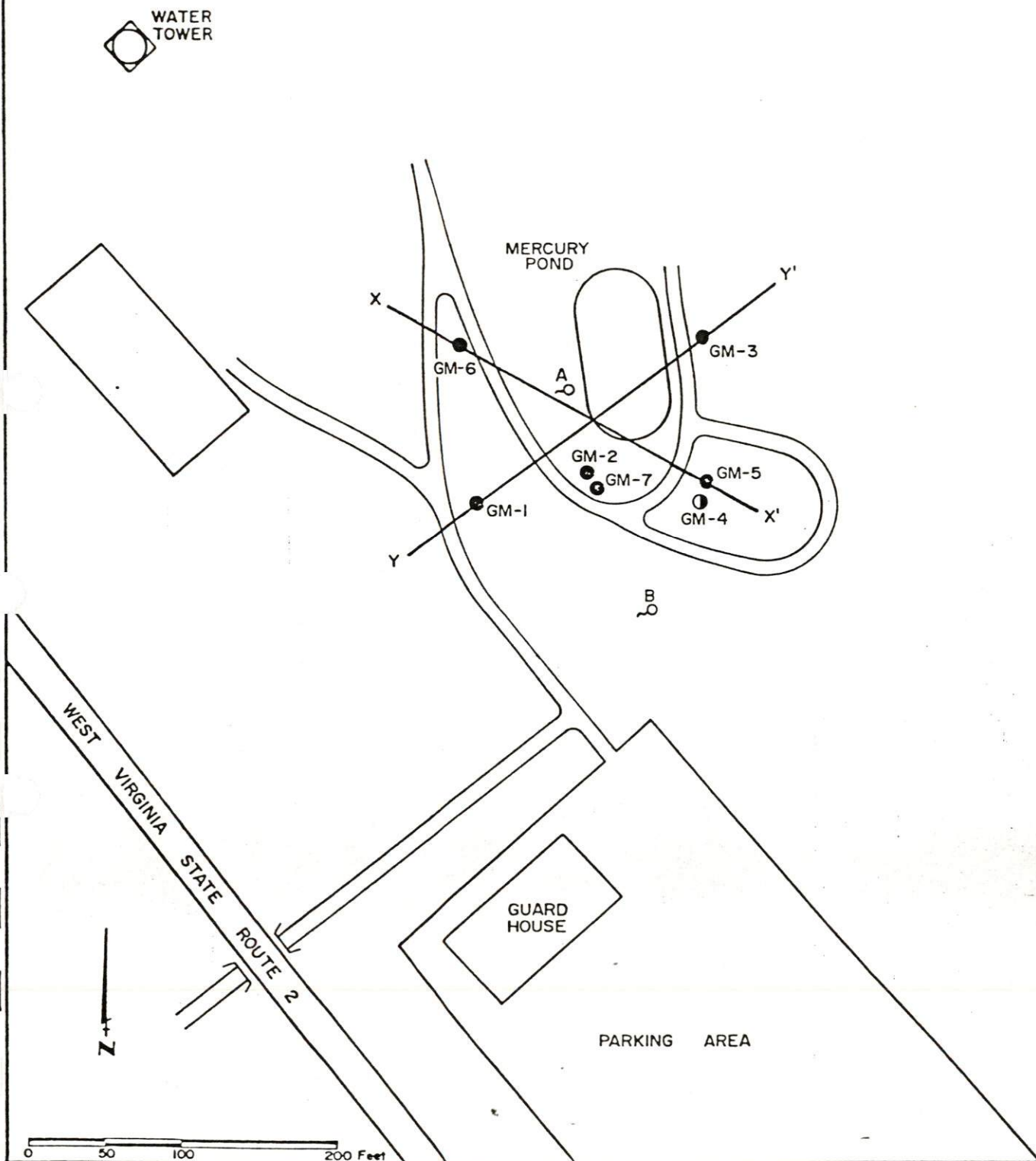
1. Tole Devices sampling pump with silicone bladder.
2. Same person takes all samples (one exception was made during the last inspection. Samples at GM-0 were taken by myself instead of Gene Haught because of time constraints.
3. Glass, polyethylene, polypropylene sample containers. Silicone bladder and Tygon tubing on pump.
4. Flow maintained at as low a rate as possible, and sample conducted down side of container. Nitrogen for sample removal outside bladder.
5. Yes.
6. Refrigeration, HNO_3 , H_2SO_4 , $\text{Na}_2\text{S}_2\text{O}_3$, CuSO_4 , and H_3PO_4 .
7. Samples filtered in Laboratory adjacent to pond. 45 micron Millipore for TOC, Cl^- , SO_4 , Fe, Mn, Na, Hg, SiO_2 , alkalinity, color, TDS, Ca, Cu, K, Zn, Mg, and V.
8. Field: Phenol, TOC before sampling.
Laboratory: Metals after sampling.
9. EPA 600/4-82-029
10. Caps - Screw, Teflon liner
Septums - Pierce Company Septums, 2.5 mw (Tuffbond).
11. Yes. Blanks are used in Laboratory for calibration and standards.
12. Flushed with distilled water. GM-0 is a drinking water production well, and the sample is taken from the discharge piping.
13. The sample is removed 12" from bottom. Always collected at this depth. The sample lines are measured and premarked for each well to insure consistent sample depth.
14. Attached.
15. Attached.
(a) MDL's are as stated in G & M methods - Natrium has done no independent determinations.

16. Not near pond, but area is contaminated by NaCl brine which was stored in this reservoir prior to its present use. During this period the concrete reservoir was unlined.
17. No.
18. No.
19. No.

Handling & Shipping

1. Samples are refrigerated.
2. Fifteen days.
3. Delivered directly to Laboratory from field. Five to fifteen minutes.

APPENDIX A:
LITHOLOGIC LOGS OF SOIL BORINGS



EXPLANATION

- | | | | |
|--------|-------------------------|------|--------------------------------|
| ● GM-3 | Monitor well and number | ○ A | Ground-water seep |
| ○ GM-4 | Borehole and number | X—X' | Line of geologic cross section |

Figure 2. Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.

Geraghty & Miller, Inc.

For several years, the facility that is now the mercury pond was used as a storage basin for sodium chloride brine produced from wells. The facility was concrete lined and used until about 1960. In the early 1970's, PPG equipped the basin with a plastic liner to handle waste flow from the plant's mercury cell, chlorine circuit. The mixed mercury waste entering the pond is precipitated as mercury sulfide and the resultant clarified liquid effluent is treated via carbon filtration prior to discharge in the Ohio River. The pond is periodically cleaned of mercury sulfide¹⁹⁷⁸ and the liner has been replaced once. (Not Strictly True) Original Liner Not removed. Placed 6" Layer Bentonite Clay on old Liner AND Installed New Liner on Top.

Location and Physical Setting

The PPG plant at Natrium, West Virginia, lies along the Ohio River approximately 30 miles (mi) south of Wheeling and 6 mi north of New Martinsville. The plant takes up the northern half of an area known as Wells Bottom, a part of the Ohio River floodplain that is 5 mi long and up to 0.4 mi wide (see Figure 1).

Wells Bottom is one of a series of alluvial features that fringe the Ohio River on alternate sides throughout its length. The bottom is composed of several recent river terraces cut into the flanks of an older and higher fluvio-glacial terrace.

The plant site rises in three steps from the river toward highlands on the east. Elevation at the plant site varies from about 620 feet (ft) at the river level to about 700 ft at the base of the highlands. The terraces rise rather abruptly but terrace tops are generally broad and flat. The high hills immediately east rise to an elevation of 1,300 ft within one mile.

REGIONAL SETTING

Geology

The Ohio River at Natrium is entrenched in Paleozoic sedimentary strata composed of sandstone, siltstone, clay, mudstone, marine limestone, fresh-water limestone, marly shale, and coal. Overlying this bedrock are Pleistocene alluvial deposits. The alluvium may be up to 120 ft thick beneath the higher Ohio River terraces and is composed of bedrock fragments of local origin and quartz, quartzite, granite, and chert which were transported south from continental glaciers. Along the edges of the valley, the river terraces may be capped by colluvial material (rock fragments) derived from bedrock highlands.

The soils along Wells Bottom at PPG are classified by the Soil Conservation Service as Made Land (includes filled and reworked material) and Brookside silt loam series. The area around the mercury pond is characterized by Brookside

soils that are deep and well drained. This soil is underlain by colluvial material derived from limestone, acid sandstone, and alkaline and acid shale (SCS, 1960). Stone fragments are common throughout the profile.

Permeability of the Brookside series ranges from 5.6×10^{-4} cm/sec (0.8 in/hr) to 3.5×10^{-3} cm/sec (5.0 in/hr) (SCS, 1960). The subsoil is yellowish brown to grayish brown and ranges in acidity from strongly acid to slightly acid. The areas of less acid soil occur mostly at the base of steeper slopes.

Water Resources

Precipitation is ample and fairly well distributed throughout the year with maximum precipitation occurring during the summer and minimum in the fall (September to November). Total annual precipitation in the Ohio Valley increases from north to south. Normal precipitation for Wheeling is 38 inches (in) and for New Martinsville, 44 in. There is no available data concerning precipitation for Natrium, but it is assumed that average precipitation at the plant site is 40 to 42 in per year.

The plant site lies along the Ohio River. River level is controlled at an elevation of approximately 623 ft by a dam to the south of the plant. The plant site naturally drains to the river via intermittent streams and overland

flow. There is no channelized flow of surface water near the mercury pond except for drainage ditches along the pond access road. Table 1 gives a summary of Ohio River water-quality at Newell and Ravenswood, West Virginia, and for Fishing Creek at New Martinsville.

Ground-Water Conditions

Ground water is found in several aquifers in the vicinity of PPG. The most important of these is the alluvial material of the Ohio River valley. Yields from wells in these sediments typically are 100 to 500 gallons per minute (gpm). The Paleozoic bedrock generally is capable of producing only small quantities of water, and quality is usually poor.

Water in the alluvium of the Ohio River valley aquifer is of generally good quality with a total dissolved solids content of around 500 mg/l or less. The water may be locally hard and sulfurous. PPG is presently pumping about 5,000 gpm from wells constructed into the alluvium.

GEOLOGY OF NATRIUM PLANT AREA

The surface strata are of the Dunkard Series of the Permian System and consist of sandstones, thin limestones, gray, green, and brown shales with thin coal streaks. The top of the Monongahela Series of the Pennsylvanian System is near stream level. The bottom member of this series is the Pittsburgh Coal, which is found at 200 to 250 feet below the land surface at Natrium. This coal is reported on drillers logs as being three to six feet thick and may be of commercial value in the future. On the flood plain and higher terraces along the Ohio River are recent deposits of sand, silt, and gravels. These deposits supply large volumes of fresh water from properly completed water wells.

The subsurface strata include the complete Geological Column as found in the Appalachian Basin and may be 18,000 feet thick at Natrium. A copy of the Generalized Stratigraphic Column as published by the West Virginia Geological Survey is attached. The deepest well drilled in the area is located in the southeastern corner of Marshall County approximately $17\frac{1}{2}$ miles east of Natrium. This well (Mars-539) was completed January 1, 1971, by Occidental Petroleum Corporation at a total depth of 16,512 feet in the Trempealeau formation of the Upper Cambrian System. It was abandoned as a dry hole.

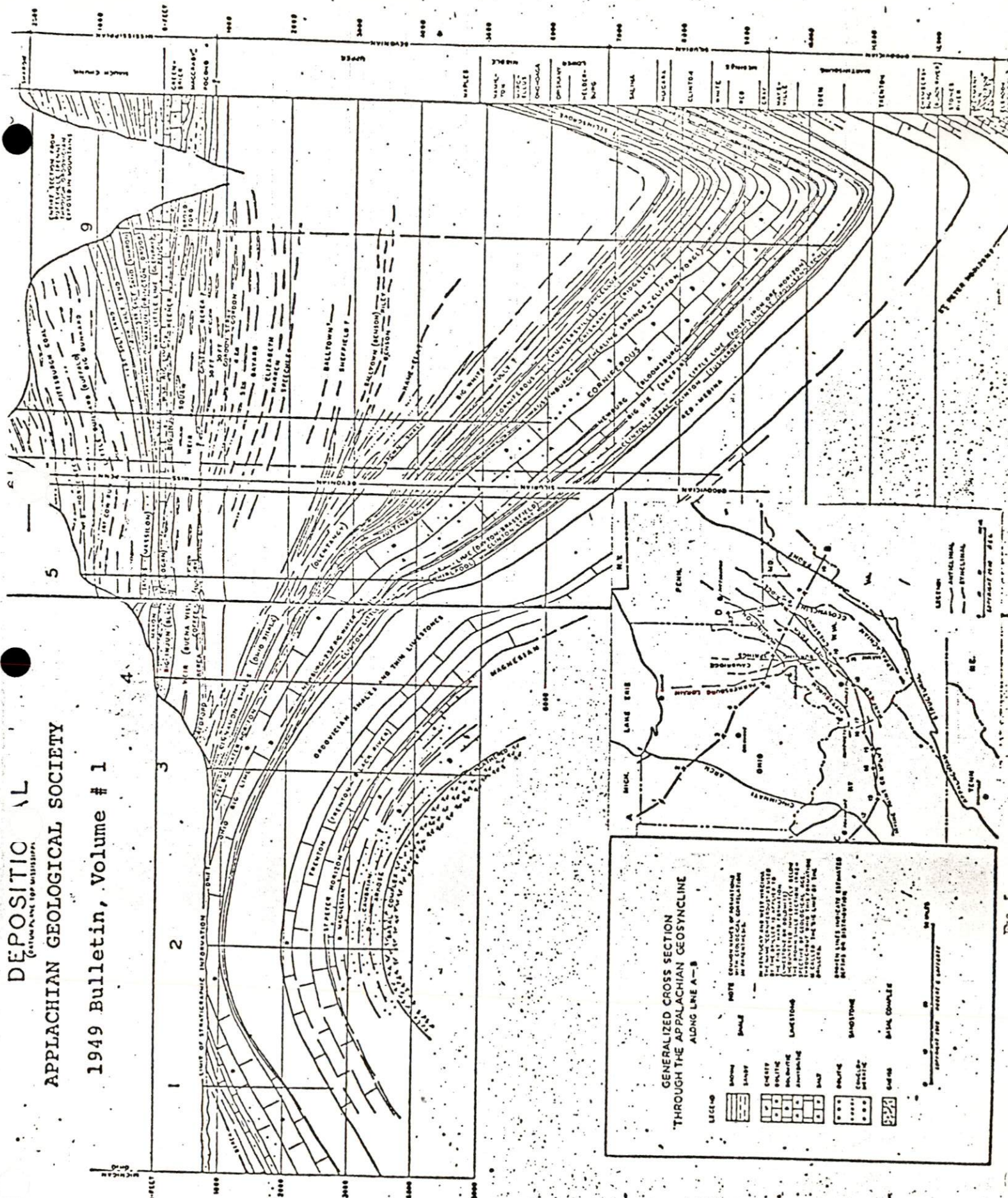
The regional dip is from the Cincinnati Arch in Central Ohio south-eastward to Central West Virginia. This regional dip averages 60 feet to the mile. The sedimentary column also thickens from west to east. A copy of a Depositional Chart as published by the Appalachian Geological Society in Bulletin #1, 1949, page 208, is attached.

Natrium is near the center of the Pennsylvanian Basin where the strata are nearly level. The sharp anticline and syncline found to the east have gradually lessened in intensity and are not recognized to the west in Ohio. The New Martinsville Anticline and the Proctor Syncline are the last folds mapped by the West Virginia Geological Survey along the western boundary of West Virginia.

GENERALIZED STRATIGRAPHIC COLUMN

GEOLOGIC SYSTEMS		TERMINOLOGY USED IN WEST VIRGINIA GEOLOGICAL SURVEY COUNTY REPORTS	TERMINOLOGY REVISED PRESENT USAGE (WOODWARD)	OIL AND GAS SANDS (DRILLERS' TERMS)*		
PERMIAN		DUNKARD				
CARBONIFEROUS	PENNSYLVANIAN MISSISSIPPIAN	MONONGAHELA		CARROLL		
		CONEMAUGH		MINSHALL MURPHY MOUNDSVILLE LITTLE DUNKARD (1ST COW RUN) BIG DUNKARD		
		ALLEGHENY		BURNING SPRINGS GAS LOWER GAS HORSE NECK		
		POTTSVILLE		2ND COW RUN SALT SANDS (1ST, 2ND, 3RD)		
		UNCONFORMITY				
		MAUCH CHUNK		PRINCETON BAYCLIFF MARTON L. LOWER MARTON LITTLE LIME		
		GREENBRIER		BLUE MONDAY BIG LIME KEENER BIG INJUN		
		POCONO		SQUAW WEIR BEREA		
		DEVONIAN	UPPER	CATSKILL	HAMPSHIRE FM.	CANTZ FIFTY-FOOT THIRTY-FOOT CORDON STRAY CORDON FOURTH FIFTH DAYARD
				CHEMUNG	CHEMUNG FM.	ELIZABETH WARREN FIRST WARREN SECOND CLARENDON OR TIONA SPEECHLEY DALLTOWN OR CHERRY GROVE ALEY RENSON CLAR OR PORTER GAGE 7
PORTAGE	BRALLIER SH.					
GENESEE	HARRELL SH.					
UNCONFORMITY	TULLY L.S.					
MIDDLE	HAMILTON		HAMILTON FM.			
	MARCELLUS		MARCELLUS SH.			
	HUNTERSVILLE		ONONDAGA L.S. HUNTERSVILLE CHERT NEEDMORE SH.	GAS IN OHIO, KY AND SOUTHERN W.VA.		
	ORISKANY		ORISKANY SS.	CARBONIFEROUS (HUNTERSVILLE CHERT) YIELDS SOME GAS IN PENNA. AND NORTHERN W.VA.		
	SHRIVER		PORT JERVIS L.S. PORT EWEN L.S. BECRAFT L.S.	ORISKANY SAND IMPORTANT GAS SAND IN MD., N.Y., OHIO, PENNA., AND W.VA.		
LOWER	HELDERBERG		NEW SCOTLAND L.S. COEYMAN'S L.S. DISCONFORMITY KEYSER L.S.	HELDERBERG HAS YIELDED SMALL VOLUMES OF GAS FROM SEVERAL WELLS IN PENNA. AND W.VA. BIG LIME OF OHIO		
	SILURIAN		BOSSARDVILLE	TONOLOWAY L.S.	NEWBURG GAS SAND IN OHIO AND W.VA. SHOWS OF OIL IN W. PENNA. LOCKPORT DOLOMITE YIELDS OIL IN KY. GAS AND OIL IN OHIO AND GAS IN SW. W.VA. KEEFER SANDSTONE (BIG SIX SAND OF SW. W.VA.) YIELDS GAS IN E. KY, OHIO, AND SW. W.VA. CLINTON SAND OF OHIO YIELDS GAS IN KY, OHIO AND W.VA. YIELDS SOME OIL IN KY. AND CENTRAL OHIO	
			RONDOUT	WILLS CREEK FM.		
			BLOOMSBURG	WILLIAMSPORT SS.		
			NIAGARA	MC KENZIE FM. (LOCKPORT OF NY.)		
CLINTON		ROCHESTER SH. KEEFER SS. ROSE HILL FM.				
ORDOVICIAN	UPPER	WHITE MEDINA	TUSCARORA SS. (CLINCH OF VA. & TENN.)	TRENTON YIELDS OIL IN N.Y., ONTARIO, PENINSULA, SE. MICH., NW. OHIO, S. CENTRAL KY., NE. TENN., AND SW. VA. SHOWS OF OIL AND GAS IN DEEP WELLS IN PENNA., OHIO AND W.VA. PRODUCES OIL IN S. CENTRAL KY. ST PETER YIELDS OIL AND GAS IN W. OHIO AND GAS IN E. KY. ST PETER SS. OR ROSE AUN. SS. NOT PRODUCTIVE AS YET OIL FOUND IN KNOX DOLOMITE IN E. KY.		
		UNCONFORMITY				
		RED MEDINA	JUNIATA FM. (QUEENSTON SH. OF NY.) (SEQUATCHIE OF VA.)			
		GRAY MEDINA	OSWEGO SS. (RICHMOND OF OHIO)			
		MARTINSBURG	REDSVILLE SH. UPPER TRENTON L.S.			
	MIDDLE	CHAMBERSBURG	MIDDLE TRENTON L.S. LOWER TRENTON L.S. BLACK RIVER L.S.			
		STONES RIVER	CHAZY L.S.			
		UNCONFORMITY				
	LOWER	BECKMANTOWN	BECKMANTOWN L.S. CHEPULTEPEC L.S.			
		CAMBRIAN	UPPER	CONOCOCHIEAGUE L.S.	CONOCOCHIEAGUE L.S.	TREMPEALEAU YIELDS OIL AND GAS IN OHIO EXPOSED ONLY IN BERKELEY AND JEFFERSON COUNTIES NOT EXPOSED IN W.VA.
MIDDLE	ELBROOK L.S.		ELBROOK L.S.			
LOWER	WAYNESBORO FM.		WAYNESBORO FM.			
	TOMSTOWN L.S.		TOMSTOWN L.S.			
	ANTIETAM SS.		ANTIETAM SS.			
	HARPERS SH.		HARPERS SH.			
	WEVERTON SS.		WEVERTON SS.			
LOUDOUN SS.	LOUDOUN SS.					
UNCONFORMITY						
PRE-CAMBRIAN CRYSTALLINES						

DEPOSITIVE AL (CONTAINING TOP MAPS) APPLACHIAN GEOLOGICAL SOCIETY 1949 Bulletin, Volume # 1



SITE INVESTIGATION

Soil Borings and Monitor-Well Installation

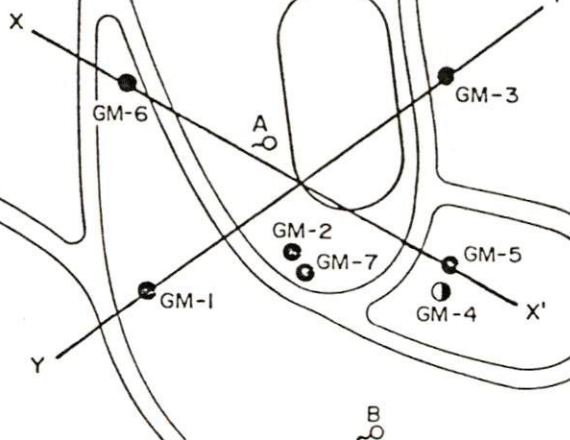
The field data-collection program was conducted during October and early November 1980. Pittsburgh Testing Laboratory, using a CME B-61 drill rig, installed boreholes to depths ranging between 45 to 100 ft at the locations shown on Figure 2. A 3-3/8-in inside diameter hollow-stem auger was used to drill through the unconsolidated material above bedrock. A 2-in outside diameter split-spoon sampler was driven ahead of the auger bit to collect soil samples. Split-spoon samples were taken at 5-ft intervals in holes GM-1, GM-2, GM-3, and GM-6. In GM-4, split-spoon samples were collected continuously from land surface to approximately 46 ft and at 5-ft intervals thereafter to 80 ft. Due to proximity to other boreholes, a limited sampling program was undertaken at GM-5 and GM-7. A 3-in outside diameter thin-walled Shelby tube sampler was used to collect undisturbed soil samples at 5 to 9 ft in GM-7, at 11 to 13 ft in GM-2, and at 27 to 29 ft in GM-3.

Samples collected using the split-spoon sampler were visually identified and logged in the field (see Appendix A for lithologic logs of all boreholes). Selected samples were analyzed in the laboratory for grain-size distribution (see Appendix B). The Shelby tube samples collected in GM-2



WATER
TOWER

MERCURY
POND



GUARD
HOUSE

PARKING AREA

0 50 100 200 Feet

EXPLANATION

● GM-3 Monitor well and number

○ GM-4 Borehole and number

~○ A Ground-water seep

X—X' Line of geologic cross section

Figure 2. Location of Monitor Wells, Soil Borings, Seeps, and Geologic Cross Sections at PPG, Natrium, West Virginia.

and GM-3 were tested in the laboratory to determine hydraulic conductivity, and those collected in GM-7 were used to prepare water extracts for the purpose of water-quality analyses.

Monitor wells were installed in all boreholes (except GM-4) using 2-in-diameter PVC casing and 0.008-in slot PVC well screen. Gravel was placed in the annulus between the screen and borehole to at least 5 ft above the top of the screen. A bentonite plug was placed on top of the gravel and a combination of Type I Portland cement and cuttings were used to seal the annular space to land surface. A 4-in steel protective casing was installed around the PVC casing above land surface. A diagram of the well construction is found in Figure 3.

Water-Quality Sampling

Following development of each monitor well to remove sediment, water samples were collected for the purpose of analysis to determine quality. Using a PVC bailer, samples were withdrawn from wells GM-1, GM-2, and GM-~~6~~⁵. In addition, water samples were collected from the mercury pond prior to release to the carbon beds, and from one of the PPG water-supply wells. There was insufficient water in wells GM-3, GM-~~5~~⁵ and GM-7 to permit sampling. The samples were analyzed for selected parameters by the PPG laboratory.

per
classroom 5.
9/83

Water samples were also collected from two seeps located below the mercury pond. Only a limited set of analyses were made on these samples.

During drilling several highly moist zones were encountered. At many locations, there was insufficient water to permit extraction via wells. In order to determine water quality in these areas, the Shelby tube sampler was used to collect soil samples that were later subjected to leaching with distilled water to allow an approximation of the quality of water in this zone. Two Shelby tube samples were collected in boring GM-7 and leached by the PPG laboratory.

SITE HYDROGEOLOGIC CONDITIONS

Topography and Drainage

The mercury pond is situated on a small and fairly level area which may be the remnant of an old river terrace. The terrace slopes very rapidly to the west below the pond and rises above the pond to the northeast to Wayne Ridge. Maximum relief of the site between GM-1 at the base of the terrace southwest of the pond to GM-3 located just northeast of the pond is 28.7 ft.

Surface drainage at the site is primarily via intermittent streams which arise east of the pond and flow to the northeast and southwest (see Figure 1). These streams

completely by-pass the pond area. Several seeps of ground water occur along the face of the terrace on which the mercury pond sits. The seeps are not sufficiently large to permit formation of channels.

Lithologic Characteristics

All seven boreholes constructed at the mercury pond encountered a heterogeneous mixture of clay, silt, sand, gravel, and weathered rock fragments overlying shaley mudstone or siltstone and sandstone bedrock. Depth to bedrock varied from approximately 50 to 100 ft and changes in bedrock elevation range from 669 ft at GM-3 to less than 595 ft at GM-1.

The diverse mixture of sediments encountered during drilling is representative of colluvial or detrital material deposited by landslides and slumping of material originating on the upland east of the pond site. Rock fragments are common throughout the sedimentary sequence.

Figures 4 and 5 present two geologic cross sections of the site as determined from boring logs. As shown in the cross sections, there is a great deal of clay present beneath the pond site. The clay layers appear to be continuous rather than lenses and range from 8 to 28 ft in thickness. Weathered rock fragments and minor amounts of gravel and

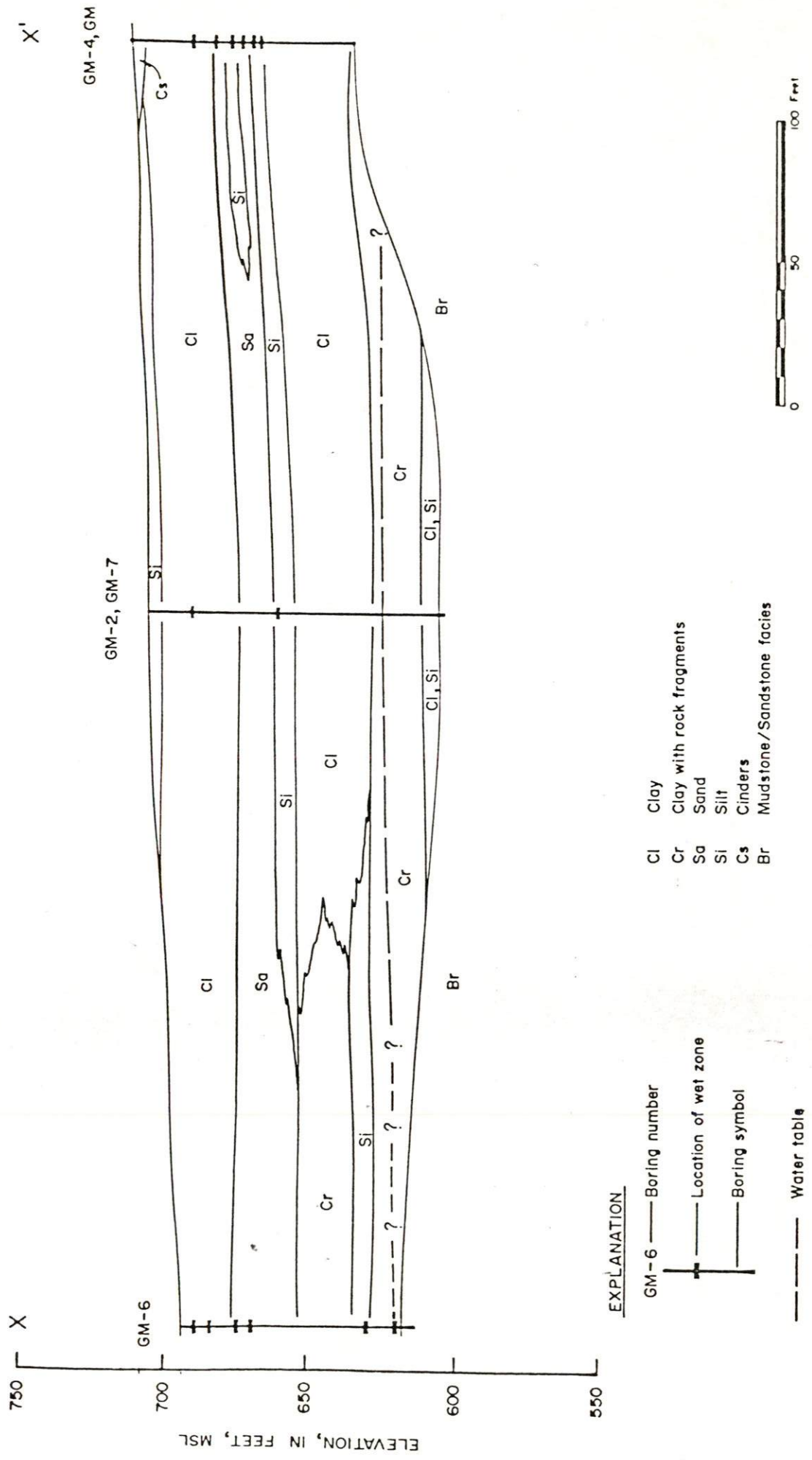


Figure 4. Geologic Cross Section (X-X'), PPG, Natrium, West Virginia.

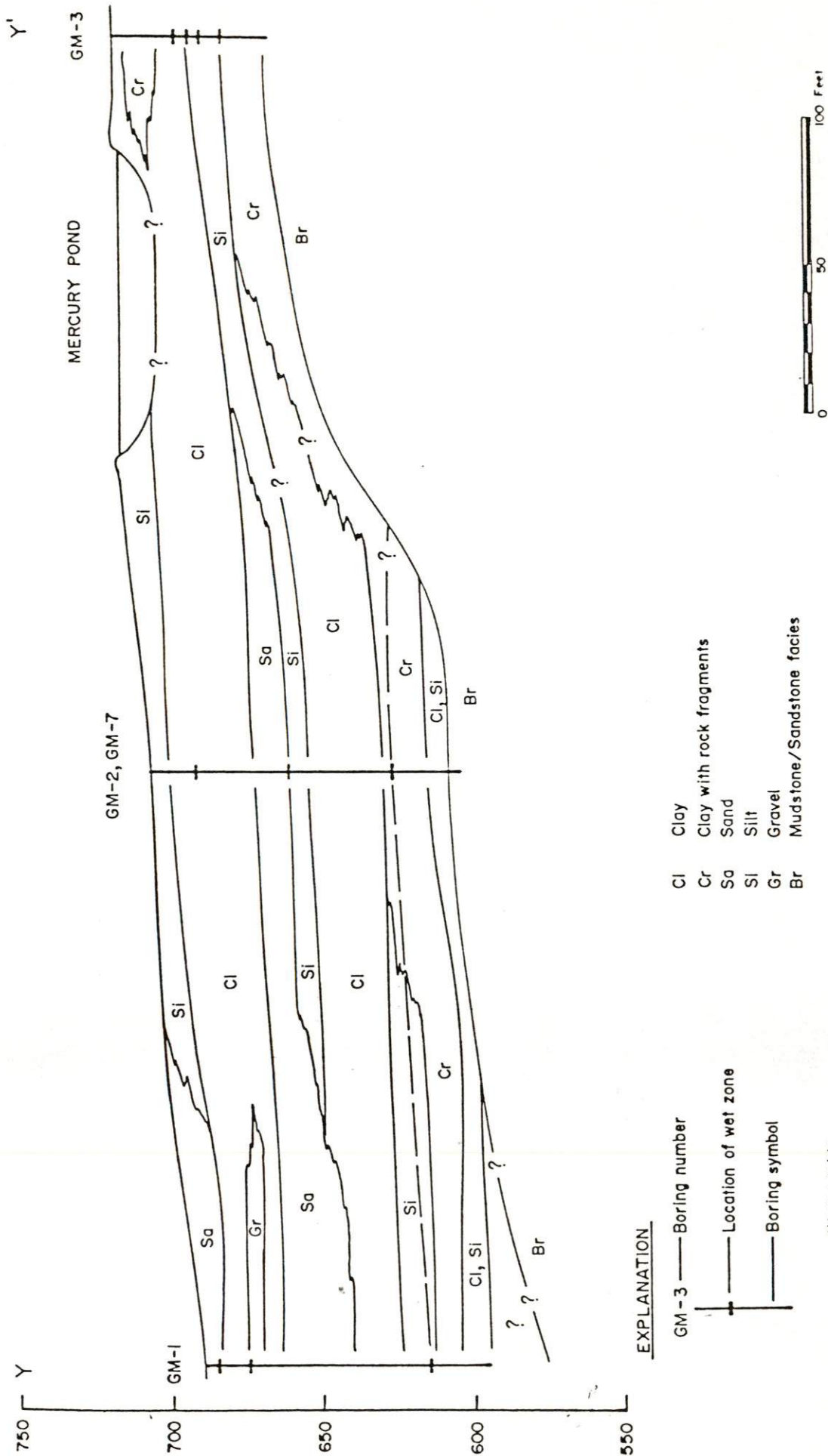


Figure 5. Geologic Cross Section (Y-Y'), PPG, Natrium, West Virginia.

silt or sand are found throughout the clay layers.

A clean, generally well sorted and dry brown sand found at most locations beneath the upper clay, generally at 20 to 30 ft below land surface, ranges from 10 to 25 ft in thickness. This unit, although occasionally moist, was never found to be thoroughly saturated with water. Underlying the sand layer is a moist to wet silt unit, 4 to 12 ft in thickness. A thick clay layer is then found above a silt unit which rests on a weathered bedrock surface. The bedrock surface rises rapidly beneath the mercury pond. The bedrock, which is composed of mudstone or fine-grained sandstone, is highly weathered at the interface.

Ground-Water Flow /

Two zones of ground water were encountered during drilling around the mercury pond: (1) a discontinuous perched water table and (2) the deeper Ohio River valley alluvial aquifer. Perched-water conditions were encountered at various depths to about 30 ft below land surface in small silt and sand layers (Table 2). These wet zones were present in all boreholes but during the fall of 1980 there was not sufficient water to be collected in the shallow wells. The perched water table may yield water to wells during spring and early summer in response to increased recharge of precipitation in the fall and winter months. (Monitor wells

were installed at GM-3, GM-5, and GM-7 to monitor the perched water table.) Several seeps along the face of the terrace below the mercury pond discharge from the perched water zone. Figure 6 shows the elevation of the lowermost perched conditions found in boreholes and maps an inferred flow system. Ground-water flow in this zone is to the west and - toward the Ohio River.

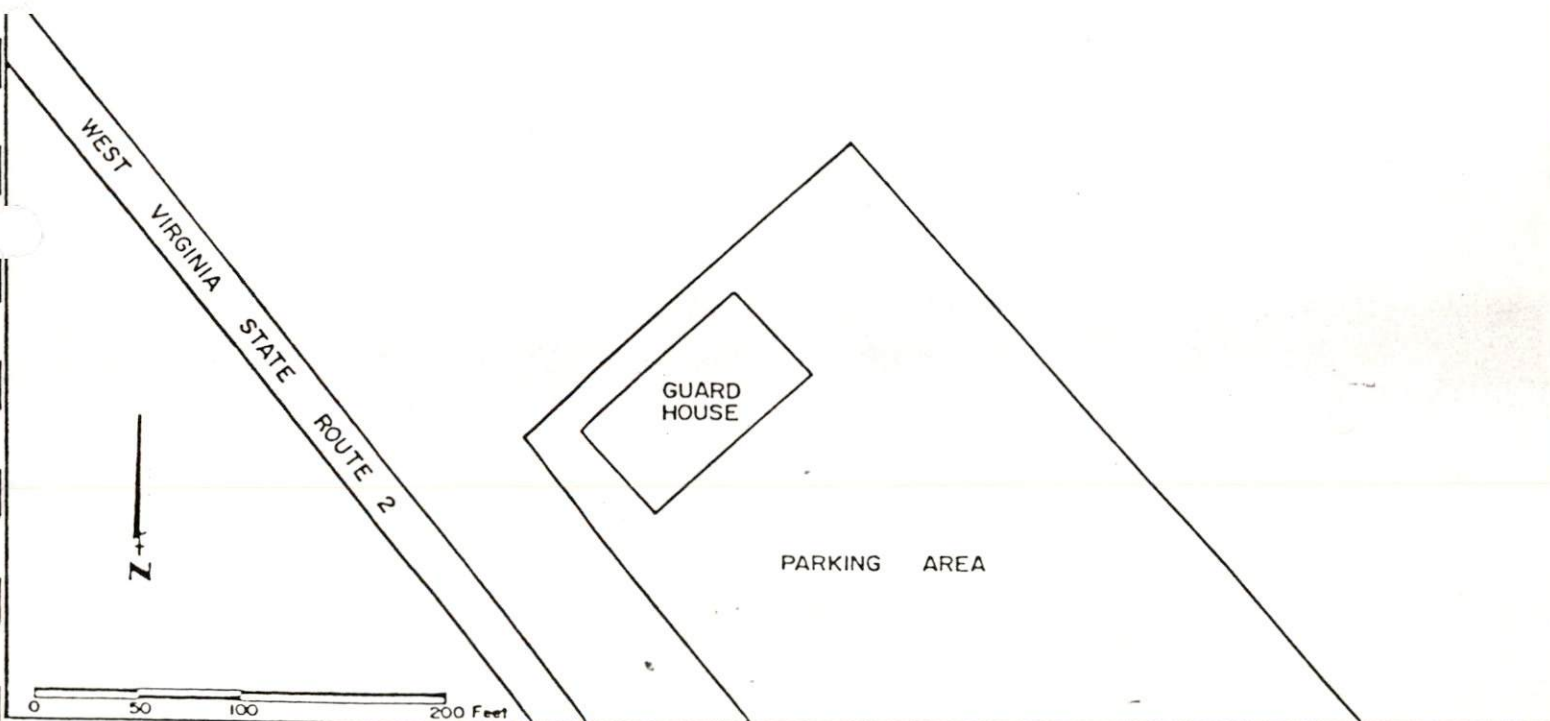
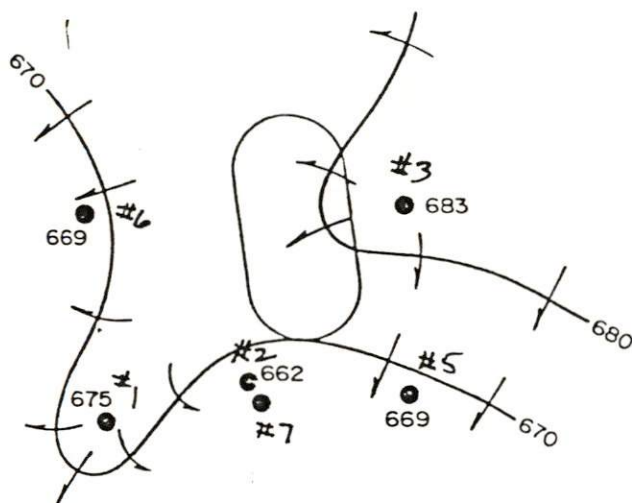
Approximately 50 ft beneath the perched water table is the semi-confined Ohio River valley alluvial aquifer. The aquifer is found in silt and fine sand at the bedrock interface. The aquifer was not encountered above the bedrock surface east of the pond. Bedrock here rises rapidly from less than 595 ft in GM-1 to 668 ft in GM-3.

Figure 7 is a water-level contour map of the alluvial aquifer as determined from water levels in the deep boreholes (GM-1, GM-2, and GM-6). Ground-water movement is toward the Ohio River. It was found that the water level in well GM-1 (615 ft) is lower than the level of the Ohio River (623 ft). Ground-water pumpage from wells at the PPG plant site is believed to be the cause of lowering the potentiometric level below the river level.

Vertical hydraulic conductivity of the clay and saturated silt beneath the mercury pond was determined in the laboratory. Water movement is extremely slow in the clays



WATER
TOWER



EXPLANATION

680 — Contour line showing bottom of
perched-water zone, in feet, msl

← Inferred direction of ground-water flow

● Monitoring point

675 Elevation of perched-water zone,
in feet, msl

Figure 6. Elevation of the Bottom of the Perched-Water Zone, PPG,
Natrium, West Virginia.

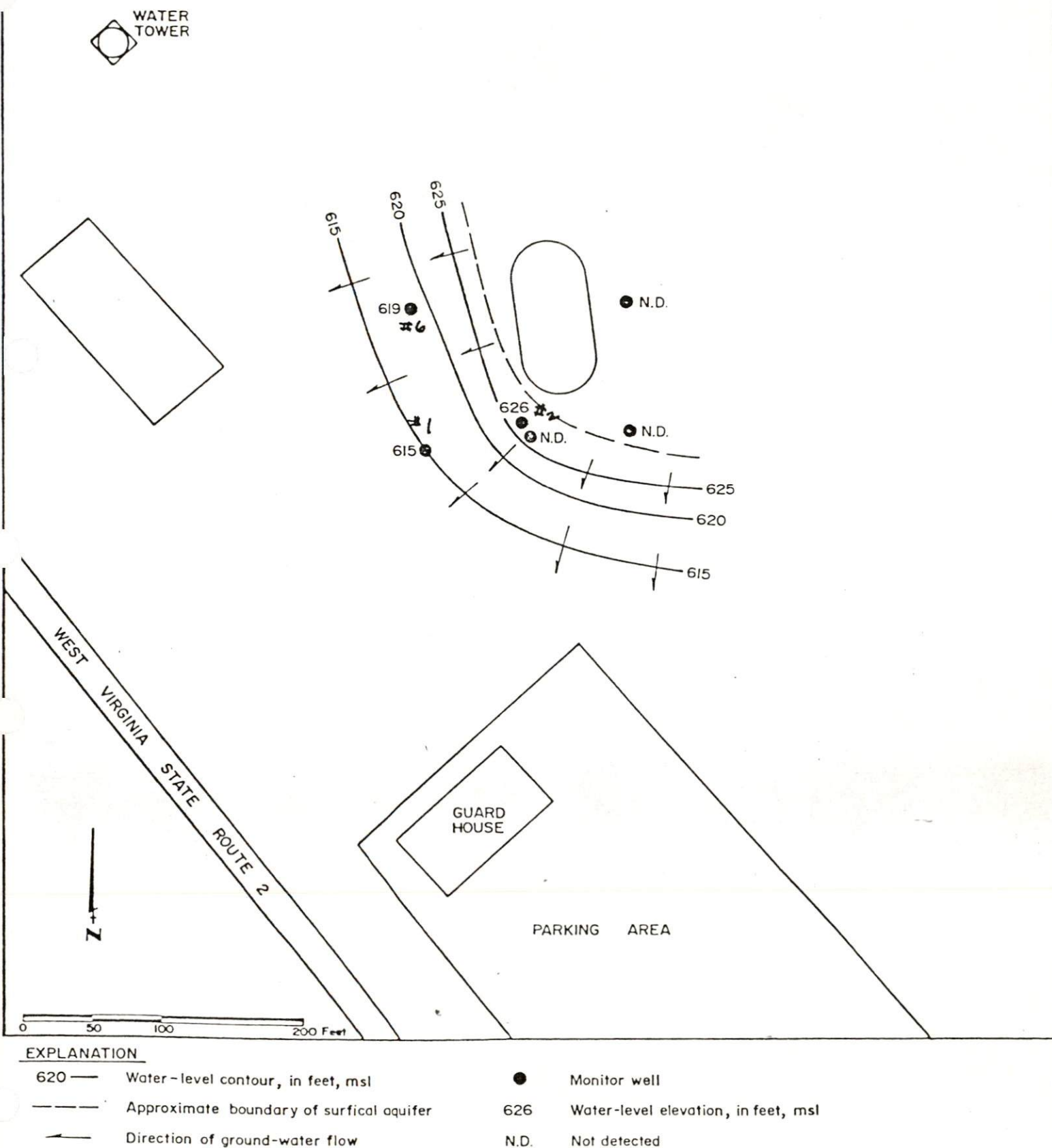


Figure 7. Water-level Contour Map of the Ohio River Alluvial Aquifer, PPG, Natrium, West Virginia.

(3.0×10^{-8} cm/sec) and slow in the silts (1.5×10^{-6} cm/sec) (Table 3). The horizontal hydraulic conductivities could not be determined, but in sediments of this type they are typically about one order of magnitude greater. Several samples collected from GM-2 and GM-7 were tested to determine cation-exchange capacities of the sediments. The analyses are presented in Table 4 and exhibit relatively low exchange capacities, 10.39 meq/100 gm and less.

Ground-Water Quality

Water samples were collected from both the perched-water zone and the Ohio River alluvial aquifer to determine natural quality conditions and the present and/or past quality effects of the mercury pond. The results of the water-quality analyses are presented in Tables 5 and 6. Table 5 contains the analyses of samples collected from wells GM-1, GM-2, and GM-~~3~~⁶; a PPG water-supply well located northwest of the mercury pond; and overflow from the mercury pond. Table 6 presents the results of leach tests run on the soil samples collected from perched-water zone and of two seeps along the face of the terrace.

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This series of water-quality samples was directed primarily at inorganic water-quality parameters, including major cations and anions and selected trace elements included in the EPA drinking water standards. It was decided to

TABLE 3. VERTICAL HYDRAULIC CONDUCTIVITIES OF SHELBY TUBE SAMPLES

Well Number	Depth Interval (ft)	Hydraulic Conductivity		Sample Description
		(cm/sec)	(ft/day)	
*GM-2	11-13	3.0×10^{-8}	8.5×10^{-5}	Clay, tight, plastic, brown and orange-tan, with weathered rock fragments, micaceous
GM-3	27-29	1.5×10^{-6}	4.2×10^{-3}	Silt, clayey, gray- green with brown mottles, wet

*sieve analyses also available for this sample

TABLE 4. CATION EXCHANGE CAPACITIES OF SELECTED LITHOLOGIC SAMPLES

Well Number	Depth Interval (ft)	Cation Exchange Capacity (meq/100 gm)	Sample Description
GM-2	13 - 14.5	5.04	Clay, tight, plastic, brown and orange tan; with weathered rock fragments
GM-2	59.5 - 61	9.62	Clay, tight, plastic, red-brown; with weathered sandstone rock fragments
GM-2	99.5 - 101	10.39	Clay, brown, wet with rock fragments; mudstone bedrock in lower half of sample
GM-7	29.5 - 31	0.0	Sand, fine grained, silty, clean, dry, orange brown to tan
GM-7	46 - 47.5	4.74	Clay, soft, moist, red-brown; with weathered sandstone fragments

TABLE 5: WATER QUALITY ANALYSES
(All analyses for parameters below are expressed in mg/l, except color and pH, which are expressed in standard units)

PARAMETERS	Sampling Points					PPG Plant Well	Maximum Contaminants Levels *
	GM-1	GM-2	GM-6	Pond Overflow To Carbon Bed			
Field Temp (°C)	14	14.5	14	-	-	-	-
Field Specific Conductance (mhos/cm)	850	1,300	550	-	-	-	-
Field pH	7.1	7.4	6.8	-	-	-	6.5 - 8.5
Total Dissolved Solids	532	1,117	338	32,200	340	340	500
Laboratory pH	7.9	7.5	7.9	11	7.2	7.2	6.5 - 8.5
Color (APHA)	15	10	5	0	0	0	15
Sodium	128	168	51.9	8,764	8.9	8.9	-
Calcium	83.9	140	84.7	16.2	111	111	-
Magnesium	28.5	24.2	10.6	1.1	10.4	10.4	-
Manganese	0.12	2.3	0.012	<0.01	<0.005	<0.005	0.05
Total Iron	<0.1	<0.1	<0.1	0.057	<0.1	<0.1	0.3
Potassium	2.5	14.6	2.6	5.3	2.5	2.5	-
Chloride	54	307	39	19,000	27	27	250
Sulfate	21	133	81	319	78	78	250
Nitrate as N	0.11	0.1	0.11	-	3.35	3.35	10
Alkalinity as CaCO ₃	564	319	235	306	196	196	-
Alkalinity as HCO ₃	688	389	287	373	239	239	-
Total Organic Carbon	60	690	9.0	-	5.0	5.0	-
Arsenic	0.015	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
Barium	0.84	0.43	0.10	0.032	0.073	0.073	1
Cadmium	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	0.01
Chromium (Total)	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	0.05
Chromium (VI)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Copper	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	1
Lead	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
Mercury	<0.0005	<0.0005	<0.0005	<0.019	<0.0005	<0.0005	0.002
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Silver	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	0.05
Zinc	<0.1	<0.1	<0.1	0.01	<0.1	<0.1	-
Fluoride	1.5	0.6	0.6	-	0.5	0.5	1.4 - 2.4

- No analysis made

* EPA Interim Primary or Secondary Drinking Water Standards

TABLE 6. SOIL LEACHATE AND WATER QUALITY ANALYSES
(All analyses for the parameters below are expressed in mg/l, except color and pH, which are expressed in standard units.)

PARAMETER	Soil Leachate					Spring	
	GM-7 (5-7 ft)		GM-7 (7-9 ft)			A	B
	1	2	1	2	2		
Total Dissolved Solids	2673	478	5043	1538	-	-	2040
pH	7.1	7.3	6.6	6.5	8.1	-	-
Color	15	83	0	0	-	-	-
Sodium	1050	219	1740	604	-	-	-
Calcium	11.0	9.8	29.7	11.4	-	-	-
Magnesium	<0.005	<0.005	8.4	0.5	-	-	-
Manganese	0.14	0.043	2.3	0.26	-	-	-
Total Iron	0.20	0.37	0.017	0.08	-	-	-
Potassium	1.8	1.8	3.0	1.6	-	-	-
Chloride	1535	328	2566	969	18176	669	275
Sulfate	71	47	67	44	390	-	-
Nitrate as N	0.3	1.0	0.4	0.3	-	-	-
Alkalinity as CaCO_3	59	49	21	33	-	-	-
Alkalinity as HCO_3	72	60	26	40	-	-	-
Total Organic Carbon	11.6	17.0	5.0	4.9	-	-	-
Arsenic	<0.005	<0.005	<0.005	<0.005	-	-	-
Barium	0.12	0.25	0.48	0.37	-	-	-
Cadmium	<0.02	<0.02	<0.02	<0.02	-	-	-
Chromium (Total)	<0.008	<0.008	<0.008	<0.008	-	-	-
Chromium (VI)	<0.01	<0.01	<0.01	<0.01	-	-	-
Copper	0.01	0.023	0.009	0.009	-	-	-
Lead	<0.005	<0.005	<0.005	<0.005	-	-	-
Mercury	<0.005	<0.005	<0.005	<0.005	<0.0002	<0.0002	<0.0002
Selenium	<0.005	<0.005	<0.005	<0.005	-	-	-
Silver	<0.005	<0.005	<0.005	<0.005	-	-	-
Zinc	0.25	0.15	0.31	0.046	-	-	-

- No analysis made

evaluate only inorganic parameters at this time because the major contaminants of concern from both the old brine operation and present mercury process are inorganic in nature.

Ohio River Alluvial Aquifer

The monitoring network installed at the mercury pond is designed to permit evaluation of the effect of the pond on ground-water quality by comparing water samples both hydraulically above and below the pond. Well GM-3 was located at a point presumed to be hydraulically upgradient and wells GM-1, GM-2, GM-6, and boring GM-4 were located hydraulically downgradient. Because of an abrupt change in elevation of the bedrock beneath the pond, however, the upgradient well (GM-3) did not intercept a water table in the alluvium. Additionally, the water table was not found in the alluvium at GM-4 and is very thin at GM-6. The Ohio River alluvial aquifer could only be sampled at locations GM-1 and GM-2. Fortunately, both of the wells are downgradient from the pond, permitting a comparison with other ground water in the aquifer away from the pond area (the PPG plant well).

The quality of water in GM-1 and the PPG plant well are very similar in quality for all parameters tested. There is no apparent elevation of mercury or any other trace metals in GM-1 and in general these levels are below detection limits.

Except for a slightly elevated total dissolved solids level, the water at GM-1 is well within acceptable health standards.

The quality in GM-2 is elevated above both GM-1 and the PPG plant well. Potassium, chloride, TDS, and TOC are all significantly higher. Mercury and all other trace elements are below detection limits as was found in GM-1 and the PPG well. At this time, these conditions should not be construed to indicate contamination resulting from the brine pond or mercury pond. During drilling of this well, drilling water was used to stabilize the borehole. It is possible that this water was not completely removed before the well was sampled. Subsequent sampling is planned to investigate this possibility.

Perched-Water Zone

Monitor wells were installed into the perched-water zone at GM-3, GM-5, and GM-7; during the fall of 1980, only well GM-5 produced sufficient water for sampling purposes. In order to assess the quality of soil water in this zone, soil samples were collected from GM-7 and subjected to a leach process using distilled water at 7.0 pH. Limited water-quality analyses were also made on two seeps along the terrace.

There is a visible indication that the perched-water zone is contaminated below the pond. Vegetation along the face of the terrace is stressed and during dry periods a

white salt crust is observed on the soil. The results of the water-quality analyses support the conclusion of contamination in the perched-water zone. Except in well GM-5, TDS, sodium, chloride, and sulfate levels are high in the perched-water zone. Several thousand mg/l of both TDS and chloride are present; both levels are far lower than that found in the mercury pond, however. Trace elements, including mercury, are not elevated in the perched zone.

Because of the absence of mercury in the perched-water zone and because the mercury pond is lined, it is theorized that the most likely source of the contaminated water was the old brine storage, and that the residual salts found in this study were deposited in the soil over 20 years ago. In many soil systems, salts are transported through the soil in pulses during rainfall or other high recharge events. This phenomenon has been seen near abandoned oil field brine storage ponds in alluvium along a river in Ohio (Pettyjohn, 1978). The data from Ohio indicates that it may take a very long time to flush this contamination from the ground-water system.



Question

5

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

Natrium Plant
Chemical Division - U.S.

January 18, 1982

CERTIFIED MAIL
RETURN RECEIPT REQUESTEDRegional Administrator
U.S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Dear Sir:

As required by the Resource Conservation and Recovery Act of 1976 [40 CFR 265.94 (a)(2)(i)], PPG Industries, Inc., is reporting the concentrations of the parameters in 265.92 (b)(1) for its first quarterly sampling of the groundwater monitoring wells at the mercury impoundment facility. This active facility is located at the Natrium, West Virginia, plant of PPG Industries, Inc., EPA I.D. No. WVD 004336343.

Attached are the first quarterly results for three downgradient wells (Nos. GM-1, GM-2, and GM-6) and a reference well (No. GM-0) in the uppermost aquifer. These analyses were reported from the laboratory on January 4, 1982.

The hydrogeological study performed prior to placement of the monitoring wells showed that there is no aquifer upgradient of the impoundment. The impoundment is located where the bedrock abruptly rises to a ridge above the impoundment. Downgradient wells are located in the uppermost valley alluvial aquifer, but, because of a heterogeneous mixture of colluvial or detrital material originating from the hillside, the water yield of these wells is poor.

Since it was not possible to take an upgradient sample, a reference well was chosen in the vicinity of the impoundment, but not directly downgradient, to provide a representative background groundwater quality in the uppermost aquifer of interest.

Section 265.94 (a)(2)(i) also requires the operator to identify separately for each monitoring well any parameters whose concentration has been found to exceed the interim primary drinking water standards. These are as follows:

Reference Well No. GM-0 - No parameter exceeded the standards.

	<u>Parameter</u>	<u>Standard</u>	<u>Concentration Found</u>
Well No. GM-1	Barium	1.0 mg/l	1.2 mg/l
	Cadmium	0.01 mg/l	0.083 mg/l
	Radium	5 pCi/l	9.0 ± 2 pCi/l
	Gross Alpha	15 pCi/l	16 ± 9 pCi/l
	Gross Beta	4 milli Rem/yr	43 ± 9 pCi/l
	Coliform Bacteria	1/100 ml	1500/100 ml

	<u>Parameter</u>	<u>Standard</u>	<u>Concentration Found</u>
Well No. GM-2	Cadmium	0.01 mg/l	0.043 mg/l
	Gross Beta	4 milli Rem/yr	19 ± 6 pCi/l
	Coliform Bacteria	1/100 ml	500/100 ml
Well No. GM-6	Cadmium	0.01 mg/l	0.041 mg/l
	Radium	5 pCi/l	5.7 ± 1 pCi/l
	Gross Alpha	15 pCi/l	12 ± 9 pCi/l
	Gross Beta	4 milli Rem/yr	13 ± 5 pCi/l
	Coliform Bacteria	1/100 ml	54,000/100 ml

These comments are pertinent to these first quarterly results.

- 1) No parameter was exceeded which is attributable to the impoundment.
- 2) Water yield is poor in these wells so that after pumping out the standing water in the wells, the incoming water was slow and generally very turbid. Turbidity reportedly affects radioactivity measurements. We are investigating this aspect.
- 3) We expect that the initial drilling activity contributed to the coliform bacteria, or perhaps the sampling procedure may have to be improved. There is no farm or septic system anywhere close.
- 4) A study is being made to see if any of the sampling or water level measuring equipment would include a cadmium compound. We would not expect to find cadmium as a result of any impoundment problem.
- 5) We expect that the ongoing quarterly monitoring will average out some of these random fluctuations.

If further information is needed, please contact me at this location.

Sincerely yours,

PPG INDUSTRIES, INC.
Natrium Plant

Warren E. Dean
Warren E. Dean
Technical Manager

WED-CED:egm

Enclosure

bcc: T. G. Brown/D. E. Shenefiel
C. E. Drum
J. W. Osheka
R. J. Samelson
F. W. Steinberg
R. F. Mitchell
File 1101.1

MERCURY IMPOUNDMENT
FIRST QUARTERLY MONITORING RESULTS

JANUARY 4, 1982

(Concentration in mg/l except as noted)

Parameters	EPA Maximum* Level Standard	M O N I T O R I N G W E L L S			
		GM-0	GM-1	GM-2	GM-6
Arsenic	0.05	<.005	0.043	0.014	0.009
Barium	1.0	0.070	1.2 ✓	0.58	0.27
Cadmium	0.01	<.010	0.083 ✓	0.043 ✓	0.041 ✓
Chromium	0.05	<.010	0.022	0.012	0.022
Fluoride	1.4-2.4	0.8	1.4	0.7	1.2
Lead	0.05	<.010	0.031	0.018	0.016
Mercury	0.002	<.0002	0.0002	0.0002	0.0002
Nitrate (as N)	10	7.5	0.25	0.14	1.68
Selenium	0.01	<.005	<.005	<.005	<.005
Silver	0.05	<.010	<.010	<.010	<.01
Endrin	0.0002	<.0002	<.0002	<.0002	<.0002
Lindane	0.004	<.0001	<.0001	<.001	<.0001
Methoxychlor	0.1	<.003	<.003	<.003	<.003
Toxaphene	0.005	<.003	<.003	<.003	<.003
2,4-D	0.1	<.010	<.010	<.010	<.010
2,4,5-TP Silvex	0.01	<.010	<.010	<.010	<.010
Radium 226, 228 pCi/l	5 pCi/l	<0.6, <1	5.9 ±1.1, 3.1 ±1.4	<.6, <1	2.6 ±.8, 3.1 ±.2
Gross Alpha pCi/l	15 pCi/l	<2	16 ±9	<2	12 ±9
Gross Beta pCi/l	4 milli Rem/yr	<3	43 ±9	19 ±6	13 ±5
Coliform Bacteria	1/100 ml	<1	1500	500	54,000

*Section 265.92 (b)(1), Appendix III - EPA Interim Primary Drinking Water Standards, FR Vol. 45, No. 98, 5/19/80 33257



PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

Natrium Plant
Chemical Division-U.S.

May 12, 1982

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Regional Administrator
U. S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Dear Sir:

As required by the Resource Conservation and Recovery Act of 1976, PPG Industries, Inc., is reporting the concentrations of the parameters in 40 CFR 265.92 (b)(1) for its second quarterly sampling of the groundwater monitoring wells at the mercury impoundment facility. This active facility is located at the Natrium, West Virginia, plant of PPG Industries, Inc., EPA I.D. No. WVD 004336343.

PPG Industries, Inc., is aware of the delayed compliance dates for the first two quarterly samplings (FR 47, No. 36, p. 7841, February 23, 1982), but the second quarterly sampling showed a few parameters above the maximum levels listed for Interim Primary Drinking Water Standards. The first quarterly report filed January 18, 1982, included results from the three downgradient wells (No. GM-1, GM-2, and GM-6) and a reference well (No. GM-0). The results from these same wells for the second quarter are attached.

The wells and parameters in excess of standards are as follows:

Well No.	Parameter	Standard	Concentration Found 2nd Qtr. (1st Qtr.)
GM-1	Barium	1.0 mg/l	1.1 mg/l (1.1)
	Cadmium	0.01 mg/l	0.026 mg/l (0.083)
	Coliform Bacteria	1/100 ml	<20/100 ml (1500)
GM-2	Cadmium	0.01 mg/l	0.036 mg/l (0.043)
	Coliform Bacteria	1/100 ml	<5/100 ml (500)
GM-6	Coliform Bacteria	1/100 ml	<20/100 ml (54000)

Regional Administrator
U. S. EPA, Region III

May 12, 1982
Page 2

Comparing the first two quarterly sampling results shows that:

- 1) No parameter was exceeded which is attributable to the impoundment.
- 2) Initial drilling probably contributed to high coliform bacteria levels which are decreasing significantly.
- 3) Cadmium levels appear to be decreasing, which may indicate some type of drilling-related contamination.
- 4) The reference well, GM-0, again had no parameter exceeding the standards.

If further information is needed, please contact me at this location.

Sincerely yours,

PPG INDUSTRIES, INC.
Natrium Plant

Warren E. Dean

Warren E. Dean
Technical Manager

WED-CED:egm

Enclosure

bcc: T. G. Brown/D. E. Shenefiel
C. E. Drum
J. W. Osheka
R. J. Samelson
F. W. Steinberg
R. F. Mitchell
File 1101.1

MERCURY IMPOUNDMENT
SECOND QUARTERLY MONITORING RESULTS
 May 10, 1982
 (Concentration in mg/l except as noted)

Parameters	EPA Maximum* Level Standard	MONITORING WELLS			
		GM-0	GM-1	GM-2	GM-6
Arsenic	0.05	<.005	0.043	0.009	<.005
Barium	1.0	.064	1.1	0.44	0.16
Cadmium	0.01	<.003	0.026	0.036	0.004
Chromium	0.05	.011	0.017	0.020	0.014
Fluoride*	1.4-2.4	1.0	1.0	1.0	2.0
Lead	0.05	<.005	0.016	0.012	<.005
Mercury	0.002	.0002	0.0002	<0.0002	0.0002
Nitrate (as N)	10	6.8	1.5	0.6	1.0
Selenium	0.01	<.005	<.005	<.005	<.005
Silver	0.05	<.004	<.004	<.004	<.004
Endrin	0.0002	<.0002	<.0002	<.0002	<.0002
Lindane	0.004	<.004	<.004	<.004	<.004
Methoxychlor	0.1	<.005	<.005	<.005	<.005
Toxaphene	0.005	<.005	<.005	<.005	<.005
2,4-D	0.1	<.010	<.010	<.010	<.010
2,4,5-TP Silvex	0.01	<.010	<.010	<.010	<.010
Radium 226, 228 pCi/l	5 pCi/l	<1.6	2.4 ± 1.2	1.2 ± 1	<1.6
Gross Alpha pCi/l	15 pCi/l	<2	<2	<2	<2
Gross Beta pCi/l	4 milli Rem/yr	<3	<3	<3	<3
Coliform Bacteria	1/100 ml	<1	<20	<5	<20



9

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA

Natrium Plant
Industrial Chemical Division - U.S.

August 6, 1982

Regional Administrator
U.S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Dear Sir:

As required by the Resource Conservation and Recovery Act of 1976, PPG Industries, Inc., is reporting the concentrations of the parameters in 40 CFR 265.92(b)(1) for its third quarterly sampling of the groundwater monitoring wells at the mercury impoundment facility. This active facility is located at the Natrium, West Virginia, plant of PPG Industries, Inc., EPA I.D. No. WVD 004336343.

The third quarterly sampling showed no parameter exceeding the Interim Primary Drinking Water Standards which would be attributed to the impoundment. Coliform bacteria counts continue to decrease. The lead parameter value in Well GM-1 appears to be suspect basis previous sampling and the other wells. Low levels of arsenic and cadmium continue to be found and may be related to turbidity stirred up by sampling.

The wells and parameters in excess of standards are as follows:

<u>Well No.</u>	<u>Parameter</u>	<u>Standard</u>	<u>Concentration Found</u>
GM-1	Arsenic	0.05 mg/l	.054 mg/l
	Cadmium	0.01 mg/l	.063 mg/l
	Lead	0.05 mg/l	.736 mg/l
GM-2	Cadmium	0.01 mg/l	0.03 mg/l
	Coliform Bacteria	1/100 ml	<5/100 ml
GM-6	Coliform Bacteria	1/100 ml	<5/100 ml

Regional Administrator
U.S. EPA, Region III

August 6, 1982
Page 2

The reference well, GM-0, had no parameter exceeding the standards. Results from the third quarterly sampling are attached.

If further information is needed, please contact me at this location.

Sincerely yours,

PPG INDUSTRIES, INC.
Natrium Plant



Warren E. Dean
Technical Manager

WED-CED:egm

Enclosure

bcc: T. G. Brown/D. E. Shenefiel
J. A. Clapperton
C. E. Drum
R. F. Mitchell
J. W. Osheka
R. J. Samelson
F. W. Steinberg
File 1101.1

MERCURY IMPOUNDMENT
THIRD QUARTERLY MONITORING RESULTS

August 3, 1982

(Concentration in mg/l except as noted)

Parameters	EPA Maximum* Level Standard	M O N I T O R I N G W E L L S			
		GM-0	GM-1	GM-2	GM-6
Arsenic	0.05	<0.005	0.054 ✓	0.012	<0.005
Barium	1.0	0.070	0.832	0.355	0.247
Cadmium	0.01	<0.004	0.063 ✓	0.030 ✓	<0.004
Chromium	0.05	0.006	0.017	0.010	0.010
Fluoride	1.4-2.4	1.3	2.0	1.0	2.0
Lead	0.05	0.014	0.736 ✓	0.003	0.030
Mercury	0.002	0.0001	0.0002	0.0001	0.0003
Nitrate (as N)	10	4.6	0.54	0.50	0.77
Selenium	0.01	<0.005	<0.005	<0.005	<0.005
Silver	0.05	<0.004	0.005	0.005	0.005
Endrin	0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Lindane	0.004	<0.004	<0.004	<0.004	<0.004
Methoxychlor	0.1	<0.10	<0.10	<0.10	<0.10
Toxaphene	0.005	<0.005	<0.005	<0.005	<0.005
2,4-D	0.1	<0.10	<0.10	<0.10	<0.10
2,4,5-TP Silvex	0.01	<0.01	<0.01	<0.01	<0.01
Radium 226, 228 pCi/l	5 pCi/l	<1.6	<1.6	<1.6	<1.6
Gross Alpha pCi/l	15 pCi/l	<2	<2	<2	<2
Gross Beta pCi/l	4 milli Rem/yr	7	<3	3	<3
Coliform Bacteria	1/100 ml	<1	<1	<5	<5



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PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA

Natrium Plant
Industrial Chemical Division - U.S.

November 22, 1982

Regional Administrator
U.S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Dear Sir:

As required by the Resource Conservation and Recovery Act of 1976, PPG Industries, Inc., is reporting the concentrations of the parameters in 40 CFR 265.92(b)(1) for its fourth quarterly sampling of the groundwater monitoring wells at the mercury impoundment facility. This active facility is located at the Natrium, West Virginia, plant of PPG Industries, Inc., EPA I.D. No. WVD 004336343.

The fourth quarterly sampling showed no parameters exceeding the Interim Primary Drinking Water Standards which would indicate impoundment leakage. The reference well, GM-0, and downgradient well, GM-2, had no parameter exceeding the standards. The number of values exceeding the Interim Primary Drinking Water Standards continues to decrease with each sampling with only arsenic in well GM-1 repeating from the last sampling. It is felt that this parameter is affected by fine sediment picked up in sampling this low yield well.

The wells and parameters in excess of standards are as follows:

<u>Well No.</u>	<u>Parameter</u>	<u>Standard</u>	<u>Concentration Found</u>
GM-1	Arsenic	0.05 mg/l	0.095 mg/l
	Barium	1.0 mg/l	1.40 mg/l
	Coliform Bacteria	1/100 ml	60/100 ml
GM-6	Lead	0.05 mg/l	0.240 mg/l

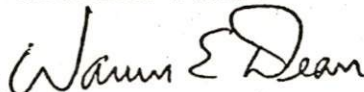
Regional Administrator
U.S. EPA, Region III

November 22, 1982
Page 2

Results of the fourth quarterly sampling are attached. If further information is needed, please contact me at this location.

Sincerely yours,

PPG INDUSTRIES, INC.
Natrium Plant



Warren E. Dean
Technical Manager

WED-CED:egm

Enclosure

bcc: T. G. Brown/D. E. Shenefiel
D. C. Cannon
J. A. Clapperton
C. E. Drum
R. F. Mitchell
R. J. Samelson/A. J. Tolmsoff
File 1101.1

MERCURY IMPOUNDMENT FOURTH QUARTERLY MONITORING RESULTS

November 15, 1982

(Concentration in mg/l except as noted)

Parameters	EPA Maximum* Level Standard	MONITORING WELLS			
		GM-0	GM-1	GM-2	GM-6
Arsenic	0.05	<0.005	0.095	0.019	0.011
Barium	1.0	0.074	1.40	0.360	0.650
Cadmium	0.01	<0.010	0.010	0.010	<0.010
Chromium	0.05	<0.010	0.010	<0.010	<0.010
Fluoride	1.4-2.4	2.0	1.0	1.0	1.0
Lead	0.05	0.016	0.045	<0.005	0.240
Mercury	0.002	<0.0005	<0.0005	<0.0005	0.0009
Nitrate (as N)	10	4.1	0.14	0.13	0.29
Selenium	0.01	<0.005	<0.005	<0.005	<0.005
Silver	0.05	0.010	0.010	<0.010	0.010
Endrin	0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Lindane	0.004	<0.004	<0.004	<0.004	<0.004
Methoxychlor	0.1	<0.100	<0.100	<0.100	<0.100
Toxaphene	0.005	<0.005	<0.005	<0.005	<0.005
2,4-D	0.1	<0.100	<0.100	<0.100	<0.100
2,4,5-TP Silvex	0.01	<0.010	<0.010	<0.010	<0.010
Radium 226, 228 pCi/l	5 pCi/l	<1	<1	<1	insuff. sample
Gross Alpha pCi/l	15 pCi/l	<1	<1	5	<1
Gross Beta pCi/l	4 milli Rem/yr.	<5	<5	<5	<1
Coliform Bacteria	1/100 ml	<1	60	<1	<1



bcc: T. Brown/D. E. Shenefiel
D. O. Cannon
J. A. Clapperton
C. E. Drum
R. F. Mitchell
R. Samelson/A. Tolmsoff/J. Osheka
File 1077.6
File 1101.2

PPG INDUSTRIES, INC./BOX 191/NEW MARTINSVILLE, WEST VIRGINIA 26155/AREA 304/455-2200

Natrium Plant
Industrial Chemical Division - U.S.

February 25, 1983

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Regional Administrator
U.S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Dear Sir:

Operators of a surface impoundment are required by 40 CFR 265.94 (amended 1/28/83) to submit annually results of groundwater well monitoring and groundwater surface elevations.

PPG Industries, Inc., is submitting the results of its first year groundwater monitoring for its active surface impoundment, EPA I.D. No. WVD 004336343, at Natrium, West Virginia, for the parameters in 265.92 (b)(3) as required by 265.94 (a)(2)(ii). Groundwater surface elevations [265.94 (a)(2)(iii)] are reported also.

The four quarterly reports for the parameters in 265.92 (b)(1) as required by 265.94 (a)(2)(i) were submitted previously.

If further information is required, please contact me at this location, or by telephone (304) 455-2200, extension 3291.

Sincerely yours,

Warren E. Dean
Warren E. Dean
Technical Manager

WED-CED:egm

Enclosures

cc: Mr. D. W. Robinson, Chief
Division of Water Resources
Department of Natural Resources

40 CFR 265.94 (a)(2)(ii) Value of Parameters in 265.92 (b)(3) for Each Groundwater Monitoring Well

Well No. GM-0 (Reference Well)

	1/4/82	5/10/82	8/3/82	11/15/82	Arithmetic Mean	Variance
pH	8.1, 7.2 7.1, 7.1	7.0, 7.0 7.0, 7.0	6.9, 7.1 7.1, 7.1	7.2, 7.0 7.0, 7.0	7.1	.01
Specific Conductance, μ mho	760, 630 620, 630	600, 600 600, 600	570, 571 570, 570	644, 652 633, 634	618	1640
Total Organic Carbon, mg/l	4.0, 2.4 2.3, 2.6	1.75, 1.82 1.84, 1.78	4.7, 4.5 4.4, 4.3	4.5, 4.4 4.3, 4.3	3.4	1.71
Total Organic Halogen, μg/l	20, 20 20, 20	100, 70 70, 100	120, 40 70, 50	20, <20 <20, <20	49	1140

Well No. GM-1

	1/4/82	5/10/82	8/3/82	11/15/82	Arithmetic Mean	Variance
pH	7.1, 7.1 7.1, 7.1	7.4, 7.4 7.3, 7.3	7.5, 7.3 7.3, 7.3	7.1, 7.1 7.2, 7.2	7.25	0.02
Specific Conductance, μ mho	1100, 1000 1010, 1100	900, 900 900, 900	966, 966 948, 944	1075, 1073 1065, 1065	995	6473
Total Organic Carbon, mg/l	23.8, 26.0 22.6, 21.4	5.86, 5.69 5.88, 5.71	13.5, 14.5 14.9, 14.0	23.4, 23.0 22.5, 22.1	16.6	69.5
Total Organic Halogen, μg/l	<20, <20 <20, <20	180, 170 170, 170	90, 90 70, 90	50, 30 20, 20	77	4913

Well No. GM-2

	<u>1/4/82</u>	<u>5/10/82</u>	<u>8/3/82</u>	<u>11/15/82</u>	<u>Arithmetic Mean</u>	<u>Variance</u>
pH	7.1, 7.1 7.1, 7.1	7.2, 7.2 7.1, 7.1	7.1, 7.1 7.1, 7.1	7.1, 7.1 7.1, 7.1	7.11	.0006
Specific Conductance, μ mho	1380, 1390 1370, 1380	1200, 1200 1200, 1200	1123, 1162 1151, 1165	1282, 1271 1261, 1249	1249	9884
Total Organic Carbon, mg/l	8.9, 20.8 8.3, 13.6	5.58, 5.39 5.38, 5.36	3.5, 3.4 3.3, 3.2	7.6, 7.5 7.4, 7.0	7.3	17
Total Organic Halogen, μ g/l	<50, <50 <50, <50	80, 100 90, 100	<20, 20 20, 40	30, <20 30, <20	48	999

Well No. GM-6

	<u>1/4/82</u>	<u>5/10/82</u>	<u>8/3/82</u>	<u>11/15/82</u>	<u>Arithmetic Mean</u>	<u>Variance</u>
pH	7.1, 7.1 7.1, 7.1	7.2, 7.1 7.1, 7.2	7.3, 7.3 7.2, 7.2	7.2, 7.2 7.1, 7.0	7.15	.0045
Specific Conductance, μ mho	850, 850 850, 840	1000, 1000 1000, 1000	833, 811 857, 875	884, 879 901, 898	896	5283
Total Organic Carbon, mg/l	19.1, 21.2 20.9, 21.7	3.61, 3.67 3.73, 3.64	8.9, 9.2 9.2, 9.2	7.3, 7.3 7.4, 7.4	10.2	54
Total Organic Halogen, μ g/l	20, 20 20, 20	40, 40 50, 30	20, 30 20, 20	<20, <20 <20, <20	25	95

40 CFR 265.94 (a)(2)(iii) Groundwater Surface Elevations in 265.93 (f)

<u>Groundwater Surface Elevations</u>				
(Relative to Mean Sea Level, Feet)				
	<u>11/81</u>	<u>3/82</u>	<u>6/82</u>	<u>9/82</u>
GM-1	612.3	611.1	610.9	611.6
GM-2	623.6	622.5	621.3	622.2
GM-6	631.1	642.4	636.7	633.0

Note: Reference Well GM-0 is northwest of the active impoundment and Wells GM-1, GM-2, and GM-6. It is not an up-gradient well because the uppermost aquifer does not occur up-gradient of the impoundment and monitoring wells. There is no means of measuring the groundwater surface elevation at Well GM-0, which is in continuous operation.

TABLE 2.
RESULTS OF CHEMICAL ANALYSES CONDUCTED DURING THE PHASE I WATER-QUALITY ASSESSMENT
AT THE PPG MERCURY POND
(all values are expressed in mg/l unless otherwise specified)

Well Location	pH (std. units)	SC (umhos/cm)	TOC	TDS	Total ALK. (as CaCO ₃)	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	SiO ₂	Hg (ug/l)	Na/Cl
<u>10/19/83 Sample Set</u>																	
GM-0	6.9	678	1.2	425	212	259	19	84	-	-	-	-	-	-	-	-	-
GM-1	7.1	1158	9.0	650	602	734	18	<10	122	1.4	100	29	0.1	1.0	11.5	<0.5	6.8
GM-2	7.0	1355	5.7	758	596	727	79	<10	172	3.0	99	23	0.9	1.7	13.4	<0.5	2.2
GM-6*	7.3	1050	7.4	635	207	253	61	188	97	2.7	98	16	<0.1	0.7	8.5	<0.5	1.6
Hg Pond	11.6	91625	4.0	85950	1424	1737	49000	1640	35200	19.4	13	<1	<0.1	<0.02	31.4	347	0.72
<u>10/27/83 Sample Set</u>																	
GM-0	7.1	719	1.4	485	202	246	27	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1178	8.1	675	599	731	49	<10	123	1.5	103	28	10.7	1.1	11.8	0.5	2.5
GM-2	7.0	1369	3.1	743	579	706	84	<10	203	3.2	92	21	5.1	1.5	13.8	<0.5	2.4
GM-6	7.2	1055	5.5	610	202	246	69	177	X	X	X	X	X	X	X	X	X
Hg Pond	12.0	61500	3.9	52400	5854	7142	29000	840	22000	17.4	16	1	0.1	<0.02	19.3	350	0.76
<u>Mean Average of 10/19/83 and 10/27/83 Data</u>																	
GM-0	7.0	699	1.3	455	207	253	23	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1168	8.6	663	601	733	34	<10	123	1.5	102	29	5.4	1.1	11.7	<0.5	3.6
GM-2	7.0	1362	4.4	751	588	717	82	<10	188	3.1	96	22	3.0	1.6	13.6	<0.5	2.3
GM-6	7.3	1053	6.5	623	205	250	65	183	97*	2.7*	98*	16*	<0.1*	0.7*	8.5*	<0.5*	1.6*
Hg Pond	11.8	76563	4.0	69175	3639	4440	39000	1240	28600	18.4	15	<1	<0.1	<0.02	25.4	349	0.73

- Not analyzed

X Insufficient sample volume for analyses

* Value based entirely on 10/19/83 data

Question
14, 15
Sampling

SAMPLING AND ANALYSIS PLAN
FOR THE PPG MERCURY POND,
NATRIUM, WEST VIRGINIA

Prepared for:

PPG INDUSTRIES, INC.
Natrium, West Virginia

By:

GERAGHTY & MILLER, INC.
Annapolis, Maryland

April, 1981

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1.0 Introduction

Section 265.92 of the U. S. Environmental Protection Agency Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (FR 45:98, 33239), requires hazardous-waste facilities to undertake a ground-water monitoring program at all facilities being operated under "Interim Status". The requirement includes the installation of monitor wells, sampling of these wells, analysis of the water samples for selected water-quality parameters, and evaluation of the collected data.

To comply with these requirements at the PPG Industries, Natrium Plant, a monitoring network has been defined based upon data contained in the report, "Evaluation of Ground-Water Quality Impacts at the PPG Mercury Pond, Natrium, West Virginia". Additionally, this "Sampling and Analysis Plan" has been prepared to delineate sampling frequency and methods, and chemical parameters and analytical methods. A companion document, the "Ground-Water Quality Assessment Plan Outline" has been prepared to delineate data evaluation procedures, reporting requirements, and development of a detailed Ground-Water Quality Assessment Plan, if needed.

2.0 Sample Collection, Preservation, and Shipment

2.1 Frequency of Sample Collection

Table 2.1 presents 44 ground-water quality parameters which must be monitored at the mercury pond site on a quarterly basis during the first year of monitoring. The table includes all parameters required by EPA in Section 265.92 in addition to ground-water quality parameters suggested by the consultant. A map of the mercury pond site showing monitor well locations is presented in Figure 1. Monitor wells GM-1, GM-2, GM-6, and the PPG water-supply well will be sampled to determine the quality of ground water in the regional Ohio River alluvial aquifer.

2.2 Equipment

Sampling equipment needed for collecting representative samples of ground water are presented below.

- 1) 100-ft fiberglass or plastic measuring tape with weighted bottom (or) water level indicator ("m-scope") consisting of an ammeter, electrode and 100-ft cable;

- 2) Several gallons of distilled water and wash bottle;
- 3) Clean rags;
- 4) Plastic sheeting or large size garbage bags;
- 5) Bottom filling PVC bailer and 120-ft nautical rope (or) Middleburg pump;
- 6) Graduated bucket;
- 7) 7 sample bottles per sampling point;
- 8) Sample bottle labels, water-proof marking pen;
- 9) pH meter;
- 10) Thermometer;
- 11) Specific conductivity meter;
- 12) Preservatives for water samples;
- 13) Field data forms, clipboard, pen; and
- 14) Optional: ice chest and ice or freezer packs.

2.3 Sample Collection Method

2.3.1 Procedures for Measuring Water Levels

- a) Place plastic sheeting around well to protect sampling equipment from potential contamination.
- b) After unscrewing outer casing cap, measure the depth to water in the well. All measurements are made from top of metal casing.
 - . Using the M-scope, drop the probe down the center of the casing and allow cord to go untangled down the well. When ammeter indicates a closed electrical circuit, determine depth to water from top of outer metal casing. Record depth to water on field data form (Figure 2). Subtract this value from elevation at top of outer casing to find elevation of water level (see Figure 3 for elevation of top of casing).
 - (or)
 - . Using a fiberglass or plastic 100-ft tape with sandpaper backing on first five feet, drop weighted tape down center of casing. After water is encountered in well, record measurement of tape at top of casing, wind up tape and record the measurement where tape is wet. Subtract the "wet" measurement from the "held" measurement to determine the depth to water. Subtract this value from the elevation at top of outer casing to find elevation of water level.

- . The water level measurements must be obtained at each sampling point every time water samples are collected. This information must be recorded and sent to the EPA Regional Administrator with the annual report (refer to the Assessment Plan for further information on reporting requirements).

c) Clean M-scope or tape bottom with distilled water and wipe dry with clean rag.

2.3.2 Procedures for Removing Standing Water in Wells

a) Remove at least one well volume of standing water using either the Middleburg pump or a hand bailer.

- . To find the volume of standing water in the well, use the following calculation:

$$V = \pi r^2 h$$

where V = volume (ft³)

$$\pi = 3.14$$

r = radius of monitor well casing (ft)

h = height or standing water in well (ft)

- . The height of standing water in the well is found by subtracting the depth to water measurement from the total depth of the well (refer to Figure 3 for depth of monitor wells)
- . It is generally recommended to remove three to five well volumes of water from the well to insure an accurate sample of ground-water quality but this may not be possible with the low yielding wells surrounding the mercury pond. At the least, the well should be pumped or bailed to dryness before sampling. Use graduated bucket to measure volume of work removed from the well.

. The "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities", pp 220 to 270, should be consulted for further information concerning the amount of water to evacuate from the well, types of pumps or bailers to use in sampling ground water, and procedures to follow for using pumps or bailers. Another reference source is the U. S. Geological Survey (USGS) publication, "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents" pp 3 to 9.

- b) Test each bailed portion of water or portions of pumped water for pH, temperature and specific conductance. Record values and discard sample.
- c) Clean bailer or pump with distilled water before use in other wells to prevent possible cross contamination of ground water in the monitor wells. If the organic parameters are a major focus of concern, one should use teflon bailers and wash with acetone or hexane after sample collection.

2.3.3 Procedures for Sample Collection and Field Analyses

- a) Allow well to recharge sufficiently to obtain samples. In some wells, this may require waiting a few minutes to a few hours; in other wells recovery time may be extremely slow and sampling may not be possible until after 24 hours. If the well is incapable of producing sufficient water required for analyses, composite sampling may be necessary where small quantities of samples are taken several days in a row.
- b) Analyses of pH, temperature, and specific conductance should be made in the field at the time of sampling because these parameters change rapidly and a laboratory analysis might not be representative of the true ground-water quality. Remove enough water from well to determine

temperature of water, specific conductivity, and pH. Record values on field data sheet and discard water.

- c) Rinse sample bottle with sampled ground water except coliform bacteria sample and the organic halogen/pesticides sample bottle (refer to Table 2.3.3).
- d) Transfer water from well sampling device to sample bottles provided by the laboratory. Care should be taken not to agitate sample in order to limit amount of added oxygen to water sample. Minimize the number of containers used in order to limit the addition of outside contaminants. Sample bottles should be prepared as specified by future EPA regulations, the 1974 EPA "Manual of Methods for Chemical Analysis of Water and Wastes" (EPA 625/6-74-0030, or as specified within this plan.
- e) Table 2.3.3 lists seven bottles which must be collected quarterly at each well during the first monitor year. These sample volumes may be increased as necessary based on laboratory needs and future EPA guidelines. The volumes listed below are based upon several EPA publications (EPA 625-16-74-003, EPA 600/4-76-049, and EPA/530/SW-611), and on the consultant's best judgement which is based upon publications and verbal communications with EPA support laboratories.
- f) If there is insufficient water in the well to supply the necessary volumes for samples specified above, the sample collector should fill up as many bottles as possible, preserve and label as required, and continue sampling daily until the remaining bottles are filled. Table 2.3.4 provides data on maximum sample holding time for the ground-water quality parameters.

2.3.4 Procedures for Sample Preservation and Shipment

Many chemical parameters are unstable in water and may change drastically before analysis if the sample is not "fixed" or

preserved at the time of sampling. Table 2.3.4 presents information on methods of preservation and this table should be used in conjunction with the information on Table 2.3.3. The procedures for sample preservation and shipment are outlined below.

- a) Add appropriate preservatives to sample bottles as listed on Table 2.3.4.
- b) Seal sample bottle caps and label bottle. Labels should show sample number, date, sample source, preservative added, if any, and analysis to be performed. Refer to sample bottle tags in Figure 4.
- c) Enter all pertinent information on field data sheets and chain of custody form.
- d) Transfer samples to ice chest for shipment to laboratory.
- e) Clean all equipment with distilled water and wipe with clean rags. Proceed to next sampling point.
- f) Shipment of samples to laboratories to perform analyses outside PPG's capabilities should be performed with as few transfers as possible. All samples must remain cooled at 4°C during shipment. Additional information concerning sampling can be found in EPA 600/4-76-049, "Handbook for Sampling and Sample Preservation of Water and Waste Water".

3.0 Laboratory Analysis of Samples

During the first monitor year, PPG must sample ground water at the mercury pond site on a quarterly basis and perform laboratory analyses for the 44 parameters listed in Table 3.0. This table provides the currently accepted analytical procedures for each water quality parameter. The appropriate reference sources are listed on the table for detailed information related to the laboratory procedures. Appendix I and II provide methods of analysis for total organic halide and total organic carbon.

If no ground-water contamination is found during the first monitor year, PPG must collect ground-water samples during the second and subsequent years on an annual and semi-annual basis. Table 2.1 presents the list of ground-water quality parameters and the frequency of sample collection. Additional information is contained in the monitoring plan. The EPA Environmental Monitoring and Support Laboratory in Cincinnati, Ohio or EPA Region III should be contacted concerning specific questions on analytical procedures, quality control, and frequency of sampling should the references mentioned above not provide adequate information to laboratory personnel.

4.0 Chain of Custody

PPG must demonstrate the reliability of data by proving the chain of possession and custody of any ground-water samples collected at the mercury pond site. There are two steps in the chain of custody procedure; 1) the transfer of bulk samples to outside laboratories. In general, a sample is in custody if it is in someone's actual physical possession, in view after being in physical possession, or in physical possession and locked up. Figure 5 presents a sample chain of custody record form to be used when transferring bulk samples to a laboratory. PPG personnel should consult EPA-600/4-76-049 "Handbook for Sampling and Sample Preservation of Water and Wastewater" or the EPA Region III personnel for specific questions concerning chain of custody requirements. At the time of report preparation, no specific steps or procedures have been required by EPA for chain of custody control. A general practice of minimal transfers of sample bottles and good record keeping should provide adequate chain of custody control.

Bibliography

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Taras, Michael J., Arnold E. Greenberg, R.D. Hoak, and M.C. Rand, 1971, Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Washington, D.C., 874 p.

Todd, David K., et al, 1976, Monitoring Groundwater Quality: Monitoring Methodology, EPA 600/4-76-026, U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 172 p.

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U.S. Environmental Protection Agency, 1980, Federal Register, Volume 45, No. 98., Monday, May 19, 1980, 33154 Part VII, Subpart F, 265.90-265.94, "Ground-Water Monitoring".

Wood, Warren W., 1976, Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents, U.S. Department of the Interior, U.S. Geological Survey, 24 p.

First Monitor Year	Ground-Water Sampling Frequency	Second
1980	1980	1980
1981	1981	1981
1982	1982	1982
1983	1983	1983
1984	1984	1984
1985	1985	1985
1986	1986	1986
1987	1987	1987
1988	1988	1988
1989	1989	1989
1990	1990	1990
1991	1991	1991
1992	1992	1992
1993	1993	1993
1994	1994	1994
1995	1995	1995
1996	1996	1996
1997	1997	1997
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2006	2006	2006
2007	2007	2007
2008	2008	2008
2009	2009	2009
2010	2010	2010
2011	2011	2011
2012	2012	2012
2013	2013	2013
2014	2014	2014
2015	2015	2015
2016	2016	2016
2017	2017	2017
2018	2018	2018
2019	2019	2019
2020	2020	2020
2021	2021	2021
2022	2022	2022
2023	2023	2023
2024	2024	2024
2025	2025	2025
2026	2026	2026
2027	2027	2027
2028	2028	2028
2029	2029	2029
2030	2030	2030
2031	2031	2031
2032	2032	2032
2033	2033	2033
2034	2034	2034
2035	2035	2035
2036	2036	2036
2037	2037	2037
2038	2038	2038
2039	2039	2039
2040	2040	2040
2041	2041	2041
2042	2042	2042
2043	2043	2043
2044	2044	2044
2045	2045	2045
2046	2046	2046
2047	2047	2047
2048	2048	2048
2049	2049	2049
2050	2050	2050
2051	2051	2051
2052	2052	2052
2053	2053	2053
2054	2054	2054
2055	2055	2055
2056	2056	2056
2057	2057	2057
2058	2058	2058
2059	2059	2059
2060	2060	2060
2061	2061	2061
2062	2062	2062
2063	2063	2063
2064	2064	2064
2065	2065	2065
2066	2066	2066
2067	2067	2067
2068	2068	2068
2069	2069	2069
2070	2070	2070
2071	2071	2071
2072	2072	2072
2073	2073	2073
2074	2074	2074
2075	2075	2075
2076	2076	2076
2077	2077	2077
2078	2078	2078
2079	2079	2079
2080	2080	2080
2081	2081	2081
2082	2082	2082
2083	2083	2083
2084	2084	2084
2085	2085	2085
2086	2086	2086
2087	2087	2087
2088	2088	2088
2089		

pH
Specific Conductance
Total Organic Carbon
Total Organic Halogen

at least
Semi-Annually
Semi-Annually
Semi-Annually
Semi-Annually

(4 replicate measurements must be obtained for each sample from PPG water-supply well)

Ground-Water Quality Parameters

Chloride
Iron¹
Manganese
Phenols
Sodium
Sulfate

at least

Drinking Water Supply Parameters

Arsenic	
Barium	
Cadmium	
Chromium (VI ² and total)	
Fluoride	
Lead	
Mercury (dissolved ² and total)	
Nitrate (N)	
Selenium	
Silver	
Endrin	
Lindane	
Methoxychlor	
Toxaphene	

[illegible]

Semi-Annually²

Ground-Water Quality Parameter

First Monitor Year

Second Monitor Year

2,4 -D
2,4,5 -TP Silvex
Radium
Gross Alpha
Gross Beta
Turbidity
Coliform Bacteria

Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly

-
-
-
-
-
-
-

Additional Parameters²

Alkalinity (as HCO₃ and CaCO₃)
Calcium
Color
Copper
Magnesium
pH, field
Specific Conductance, field
Potassium
Total Dissolved Solids
Zinc

Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly
Quarterly

-
-
-
-
-
Semi-Annually²
Semi-Annually²
-
Semi-Annually²
-

¹All metals are Total metals (not dissolved) unless otherwise specified.
²Additional parameters recommended by consultant, not required by EPA.

TABLE 2.3.3: LIST OF SAMPLE BOTTLE SIZE AND SAMPLE PRESERVATION

- (1) Use a 500 ml clean plastic or glass sample bottle for the following parameters:

pH (laboratory)¹
specific conductance (laboratory)¹
chloride²
iron²
sulfate²
fluoride³
turbidity³
alkalinity (as HCO₃ and CaCO₃)⁴
calcium⁴
color⁴
mercury, dissolved⁴
potassium⁴
total dissolved solids⁴

Cool bottle at 4°C.

- (2) Use a 500 ml clean glass sample bottle washed with nitric acid for the following parameters:

manganese²
sodium²
arsenic³
barium³
cadmium³
chromium, hexavalent⁴ and total³
lead³
mercury, total³
selenium³
silver³
copper⁴
magnesium⁴
zinc⁴

Acidify samples with HNO₃ to pH <2; cool at 4°C. All metals are total metals unless otherwise specified.

- (3) Use a 500 ml clean glass sample bottle for the following parameters:

total organic carbon¹
nitrate (as N)³

Acidify sample with H₂SO₄ to pH <2; cool at 4°C.

- (4) Use a 500 ml clean glass sample bottle for:

phenols²

Acidify with H_3PO_4 to pH <4; cool at 4°C.

- (5) Use a 500 ml clean, glass sample bottle, solvent washed, with teflon-lined caps for the following parameters:

total organic halogen¹

endrin³

lindane³

methoxychlor³

toxaphene³

2,4-D³

2,4,5-TP Silvex³

DO NOT RINSE SAMPLE BOTTLE WITH WATER SAMPLE BEFORE SAMPLING.
Cool bottles at 4°C.

- (6) Use a 100 ml sterile glass sample bottle and sterile cap for:

coliform bacteria

Cool at 4°C.

- (7) Use a 100 ml clean glass sample bottle cleaned with nitric acid and rinsed with double distilled water for the following parameters:

radium³

gross alpha³

gross beta³

¹Ground-Water Contamination Indicators

²Ground-Water Quality Parameters

³Drinking Water Supply Parameters

⁴Additional Parameters Recommended by Consultant for First Year of Monitoring

TABLE 2.3.4: SAMPLE BOTTLE PRESERVATION

WATER QUALITY PARAMETER	CONTAINER	METHOD OF PRESERVATION ¹	HOLDING TIME
<u>Ground-Water Contamination Indicators</u>			
pH	P, G ⁴	Cool 4°C	6 hrs
Specific Conductance	P, G	Cool 4°C	24 hrs
Total Organic Carbon	P, G	H ₂ SO ₄ to pH<2; Cool 4°C	24 hrs
Total Organic Halogen	G	(6)	(6)
<u>Ground-Water Quality Parameters</u>			
Chloride	P, G	none	7 days
Iron, total	P, G	HNO ₃ to pH<2	6 mos
Manganese, total	P, G	HNO ₃ to pH<2	6 mos
Phenols	G	H ₃ PO ₄ to pH<4; Cool 4°C	24 hrs
Sodium, total	P, G	HNO ₃ to pH<2; Cool 4°C	6 mos
Sulfate	P, G	Cool 4°C	7 days

WATER QUALITY PARAMETER	CONTAINER	METHOD OF PRESERVATION ¹	HOLDING TIME
<u>Drinking Water Supply</u> Parameters			
Arsenic, total	P, G	HNO ₃ to pH<2	6 mos
Barium, total	P, G	HNO ₃ to pH<2	6 mos
Cadmium, total	P, G	HNO ₃ to pH<2	6 mos
Chromium, hexavalent ²	P, G	HNO ₃ to pH<2	24 hrs
Chromium, total	P, G	HNO ₃ to pH<2	6 mos
* Fluoride, total	P, G	Cool 4°C	7 days
Lead, total	P, G	HNO ₃ to pH<2	6 mos
Mercury, dissolved ²	G	Filter; HNO ₃ to pH<2	38 days
Mercury, total	G	HNO ₃ to pH<2	38 days
Nitrate (N)	P, G	H ₂ SO ₄ to pH<2; Cool 4°C	24 hrs
Selenium, total	G	HNO ₃ to pH<2	6 mos
Silver, total	G	HNO ₃ to pH<2	6 mos
Endrin ³	G ⁵	none 5	(6)
Lindane ³	G ⁵	none 5	(6)
Methoxychlor ³	G ⁵	none 5	(6)
Toxaphene ³	G ⁵	none 5	(6)
2,4-D ³	G ⁵	none 5	(6)

WATER QUALITY PARAMETER	CONTAINER	METHOD OF PRESERVATION ¹	HOLDING TIME
<u>Drinking Water Supply Parameters (Cont)</u>			
2,3,5-Tp Silvex ³	G ⁵	none 5	(6)
Radium	G	(6)	(6)
Gross Alpha	G	(6)	(6)
Gross Beta	G	(6)	(6)
Turbidity	P, G	Cool 4°C	7 days
Coliform Bacteria, total	G	Cool 4°C	24 hrs
<u>Additional Parameters²</u>			
Alkalinity (as HCO ₃ and CaCO ₃)	P, G	Cool 4°C	24 hrs
Calcium, total	P, G	Cool 4°C	6 mos
Color	G	Cool 4°C	24 hrs
Copper, total	G	HNO ₃ to pH<2	6 mos
Magnesium, total	P, G	HNO ₃ to pH<2	6 mos
pH, field	P, G	determine on site	-
Specific Conductance, field	P, G	determine on site	-

WATER QUALITY PARAMETER	CONTAINER	METHOD OF PRESERVATION ¹	HOLDING TIME
<u>Additional Parameter² (Cont)</u>			
Potassium, total	P	Cool 4°C	6 mos
Total Dissolved Solids (TDS)	P, G	Cool 4°C	7 days
Zinc, total	G	HNO ₃ to pH<2	6 mos

¹ Primary data sources: p. viii, EPA-625/6-74-003 "Methods for Chemical Analysis of Water and Wastes" and Chapter 10, EPA-600/4-76-049, "Handbook for Sampling and Sample Preservation of Water and Wastewater."

² Additional parameters recommended by consultant, not required by EPA.

³ Also refer to "Methods for Chlorinated Phenoxy Acid Herbicides in Industrial Effluents" MDQARL, EPA, Cincinnati, Ohio, November 28, 1973 and "Method for Organochloride Pesticides in Industrial Effluents" MDQARL, EPA, Cincinnati, Ohio, November 28, 1973.

⁴ P = Polyethylene bottles
G = Glass bottles

⁵ Do NOT rinse container with ground water before sample collection.

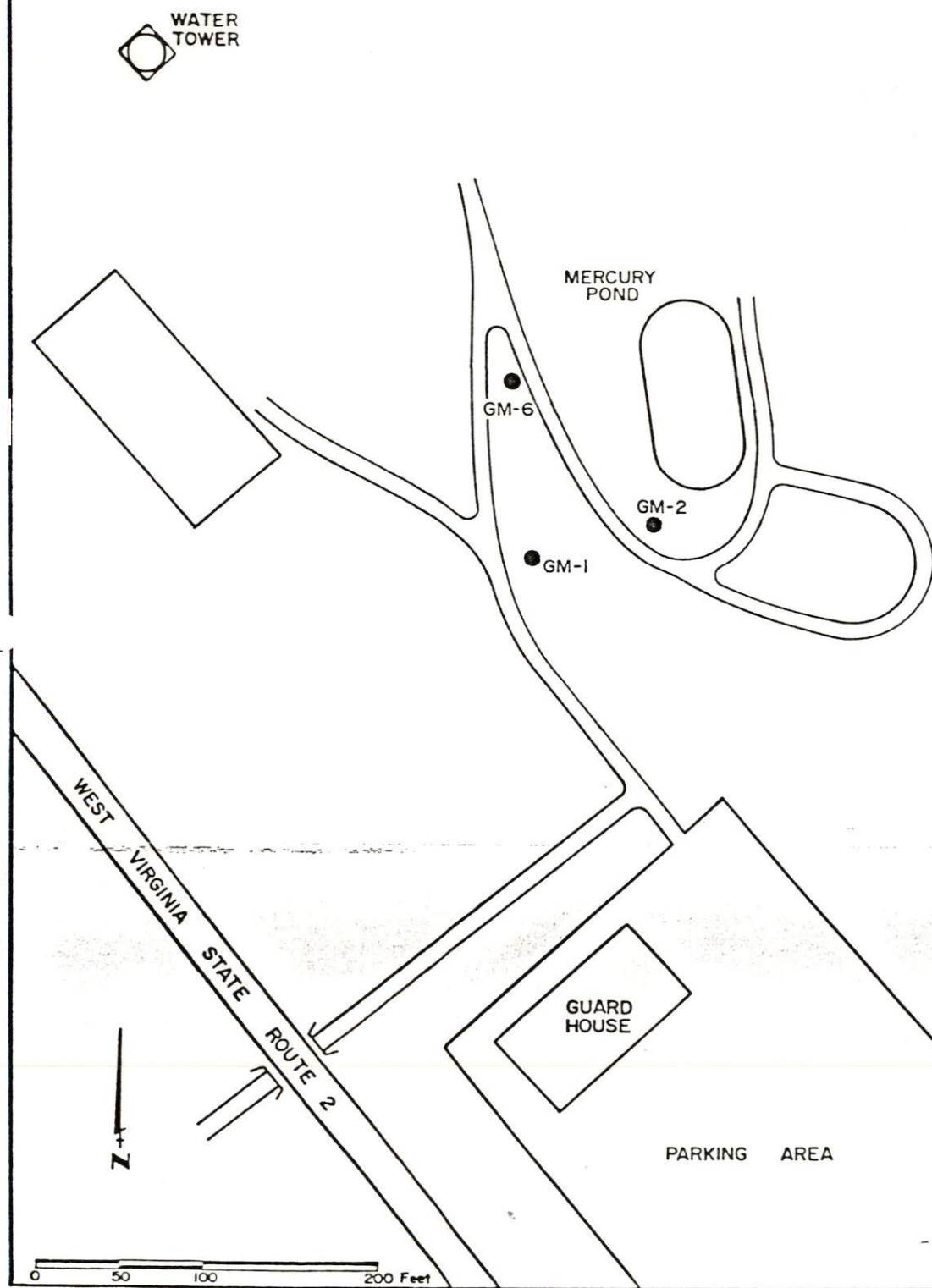
⁶ Refer to EPA guidelines and regulations for more information.

TABLE 3.0: ANALYTICAL PROCEDURES

WATER QUALITY PARAMETERS	ANALYTICAL PROCEDURES ¹	REFERENCES (page number)	
		1974 EPA METHODS	14th EDITION STANDARD METHODS 1975 Part 31 ASTM
<u>Ground-Water Contamination Indicators</u>			
pH	Electrometric measurement Field analysis preferred	239	460 178
Specific Conductance	Wheatston bridge conductimetry	275	71 120
Total Organic Carbon	Combustion - infrared method	236	532 467
Total Organic Halogen	Microcoulometric-titration detection method. Refer to Method 450.1 included in the appendix	-	-
<u>Ground-Water Quality Parameters</u>			
Chloride	Silver nitrate; mercuric nitrate; or automated colorimetric-ferricyanide	29; 31	303; 304; 613 267; 625
Iron, total	Digestion followed by atomic absorption; or colorimetric (Phenanthroline)	110	148; 208 345; 328
Manganese, total	Digestion followed by atomic absorption; or colorimetric (Persulfate or periodate)	116	148; 225; 227 345
Phenols	Colorimetric (4AAP)	241	582 545
Sodium, total	Digestion followed by atomic absorption; or flame photometric	147	250 403
Sulfate	Gravimetric; turbidimetric; or automated colorimetric (barium chloranilate)	277; 279	493; 496 424; 425

WATER QUALITY PARAMETERS	ANALYTICAL PROCEDURES ¹	REFERENCES (page number)	
		1974 EPA METHODS	14th EDITION STANDARD METHODS 1975 Part 31 ASTM
<u>Drinking Water Supply Parameters</u>			
Arsenic, total	Digestion followed by silver diethyldithiocarbamate; or atomic absorption	9; 95	285; 283; 159 -
Barium, total	Digestion followed by atomic absorption	97; 98	152 -
Cadmium, total	Digestion followed by atomic absorption; or colorimetric (Dithizone)	101	148; 182 345
Chromium, hexavalent ²	Extraction and atomic absorption; colorimetric (Diphenylcarbazide)	89; 105	192 -
Chromium, total	Digestion followed by atomic absorption; or colorimetric (Diphenylcarbazide)	105	148; 192 345; 286
Fluoride, total	Distillation followed by ion electrode; SPADNS; or automated complexone	65; 59; 61	389; 391; 393 614 307; 305
Lead, total	Digestion followed by atomic absorption; or colorimetric (Dithizone)	112	148; 215 345
Mercury, dissolved ²	Filter with 0.45 micron paper followed by the referenced method for total manganese		
Mercury, total	Flameless atomic absorption	118	156 338
Nitrate (N)	Cadmium reduction; brucine sulfate; automated cadmium or hydrazine reduction	201; 197; 207	423; 427; 620 620 358
Selenium, total	Digestion followed by atomic absorption;	145	159 -
Silver, total	Digestion followed by atomic absorption; or colorimetric (Dithizone)	146	148; 243 -

WATER QUALITY PARAMETERS	ANALYTICAL PROCEDURES ¹	REFERENCES (page number)		
		1974 EPA METHODS	14th EDITION STANDARD METHODS	1975 Part 31 ASTM
<u>Drinking Water Supply</u> <u>Parameters</u>				
Endrin ³	EPA Method 625; Gas chromatography	December 3, 1979 Federal Register	555	-
Lindane ³	EPA Method 625; Gas chromatography	December 3, 1979 Federal Register	555	-
Methoxychlor ³	Gas Chromatograph	-	555	-
Toxaphene ³	EPA Method 625; Gas chromatography	December 3, 1979 Federal Register	555	-
2,4-D ³	Gas Chromatography	-	555	-
2,4,5-TP Silvex ³	Gas Chromatography	-	555	-
Radium	Proportional counter; scintillation counter	-	661	661
Gross Alpha	Proportional counter; scintillation counter	-	648	591
Gross Beta	Proportional counter	-	648	601
Turbidity	Nephelometric method	295	132	223
Coliform Bacteria, total	Most Probable Number (MPN): membrane filter	916; 928	-	35



EXPLANATION

● GM-2 Monitor well and number

FIGURE 1: MONITOR WELL LOCATION MAP

FIGURE 2. GROUND WATER SAMPLING DATA FORM

Spring/Well Number: _____
Sampled by: _____

Date: _____
Time: _____ to _____
Weather: _____

A. GROUND-WATER ELEVATION

- (1) Length of Tape Held _____ (or) m-scope reading _____
at Top of Outer Casing: _____
- (2) Length of Tape Wet: _____
- (3) Depth to Water (1 minus 2): _____
- (4) Depth to Well Bottom: _____
- (5) Height to Water Column, h (4 minus 3): _____

B. WATER SAMPLING DATA

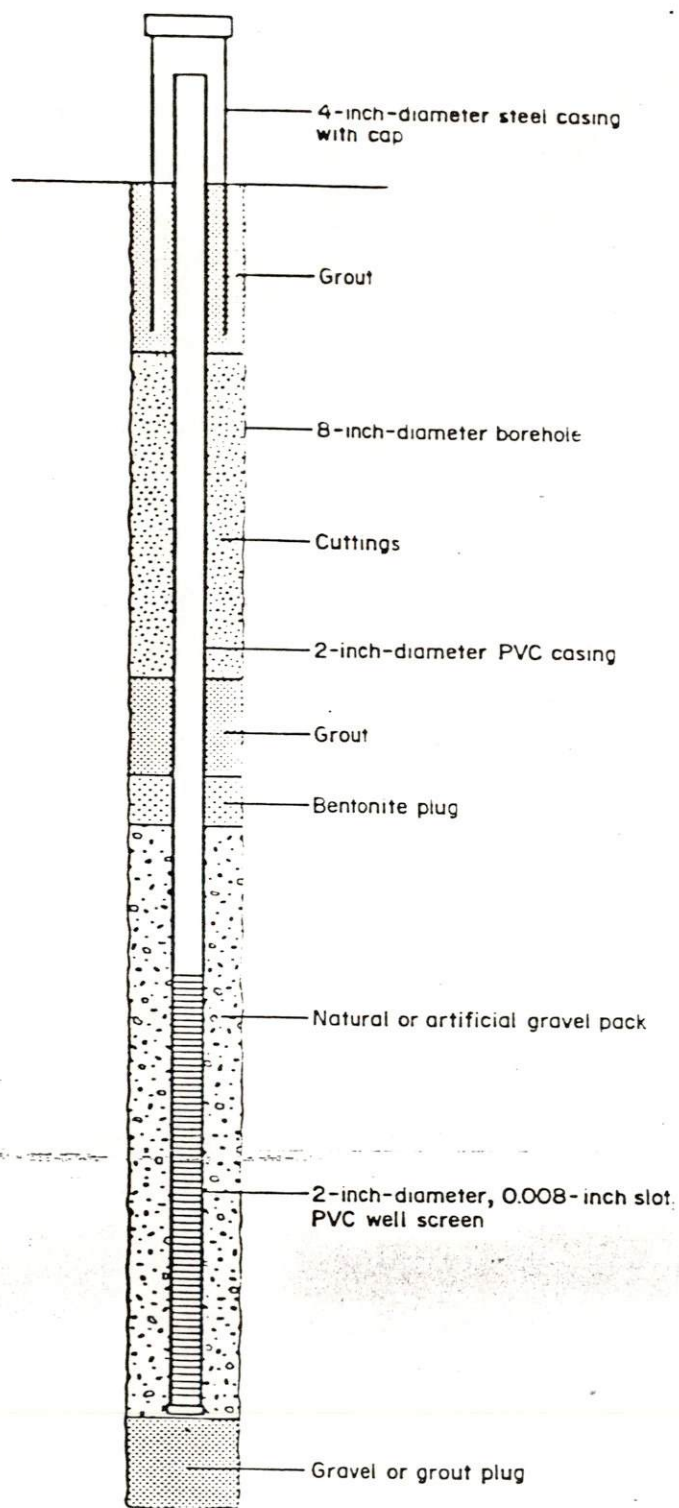
- (1) Volume of water in well = $\pi r^2 h = (3.14)(.083 \text{ ft})^2 (h) =$

- (2) Amount of water removed from well: _____
- (3) Was well pumped dry? _____

C. FIELD ANALYSES AND REMARKS

- (1) Temperature: _____
- (2) Specific Conductance: _____
- (3) pH: _____
- (4) Physical Appearance: _____
- (5) Number & Type of Samples Collected: _____

- (6) Remarks _____



Well Number	Elevation* (ft)	Total Depth* (ft)
GM-1	693.10	99
GM-2	709.88	102
GM-6	696.90	78

* Measurement from top of outer casing.

FIGURE 3: ELEVATION AND DEPTH OF MONITOR WELLS

FIGURE 4.
CHAIN OF CUSTODY RECORD - BOTTLE SAMPLE TAG

PPG MERCURY POND: GROUND-WATER MONITORING			
SAMPLE #	COLLECTION DATE		TIME
SAMPLE SOURCE	PRESERVATIVE		
SAMPLE COLLECTOR (signature)			
REMARKS (analysis required, etc.)			

FRONT

Sample relinquished from:	Sample received:	Date/Time
Sample relinquished from:	Sample received:	Date/Time
Sample relinquished from:	Sample received:	Date/Time
Method of shipment:		

BACK

FIGURE 5. CHAIN OF CUSTODY RECORD

SAMPLE COLLECTOR'S NAME:

DATE	TIME	SAMPLE #	SAMPLE SOURCE	SAMPLE VOLUME	# OF CONTAINERS	ANALYSIS REQUIRED
Relinquished by: (signature)		Received by: (signature)		Date/Time		
Relinquished by: (signature)		Received by: (signature)		Date/Time		
Relinquished by: (signature)		Received by: (signature)		Date/Time		
Dispatched by: (signature)		Date/Time:		Method of Shipment:		
Received at Laboratory		Date/Time:				

APPENDIX I
TOTAL ORGANIC HALIDE

Method 450.1

Interim

U S. Environmental Protection Agency
Office of Research and Development
Environmental Monitoring and Support Laboratory
Physical and Chemical Methods Branch
Cincinnati, Ohio 45268

November 1980

TOTAL ORGANIC HALIDE

Method 450.1

1. Scope and Application

- 1.1 This method is to be used for the determination of Total Organic Halides as Cl^- by carbon adsorption, and requires that all samples be run in duplicate. Under conditions of duplicate analysis, the reliable limit of sensitivity is 5 $\mu\text{g/L}$. Organic halides as used in this method are defined as all organic species containing chlorine, bromine and iodine that are adsorbed by granular activated carbon under the conditions of the method. Fluorine containing species are not determined by this method.
- 1.2 This is a microcoulometric-titration detection method applicable to the determination of the compound class listed above in drinking and ground waters, as provided under 40 CFR 265.92.
- 1.3 Any modification of this method, beyond those expressly permitted, shall be considered as major modifications subject to application and approval of alternate test procedures under 40 CFR 260.21.
- 1.4 This method is restricted to use by, or under the supervision of, analysts experienced in the operation of a pyrolysis/microcolumeter and in the interpretation of the results.

2. Summary of Method

- 2.1 A sample of water that has been protected against the loss of volatiles by the elimination of headspace in the sampling container, and is free of undissolved solids, is passed through a column containing 40 mg of activated carbon. The column is washed

to remove any trapped inorganic halides, and is then pyrolyzed to convert the adsorbed organohalides to a titratable species that can be measured by a microcoulometric detector.

3. Interferences

3.1 Method interferences may be caused by contaminants, reagents, glassware, and other sample processing hardware. All of these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running method blanks.

3.1.1 Glassware must be scrupulously cleaned. Clean all glassware as soon as possible after use by treating with chromate cleaning solution. This should be followed by detergent washing in hot water. Rinse with tap water and distilled water, drain dry, and heat in a muffle furnace at 400°C for 15 to 30 minutes. Volumetric ware should not be heated in a muffle furnace. Glassware should be sealed and stored in a clean environment after drying and cooling, to prevent any accumulation of dust or other contaminants.

3.1.2 The use of high purity reagents and gases help to minimize interference problems.

3.2 Purity of the activated carbon must be verified before use. Only carbon samples which register less than 1000 ng/40 mg should be used. The stock of activated carbon should be stored in its granular form in a glass container with a Teflon seal. Exposure to the air must be minimized, especially during and after milling and sieving the activated carbon. No more than a two-week supply

should be prepared in advance. Protect carbon at all times from all sources of halogenated organic vapors. Store prepared carbon and packed columns in glass containers with Teflon seals.

3.3 This method is applicable to samples whose inorganic-halide concentration does not exceed the organic-halide concentration by more than 20,000 times.

4. Safety

The toxicity or carcinogenicity of each reagent in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. The laboratory is responsible for maintaining a current-awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of material-handling data sheets should also be made available to all personnel involved in the chemical analysis.

5. Apparatus and Materials (All specifications are suggested. Catalog numbers are included for illustration only).

5.1 Sampling equipment, for discrete or composite sampling

5.1.1 Grab-sample bottle - Amber glass, 250-mL, fitted with Teflon-lined caps. Foil may be substituted for Teflon if the sample is not corrosive. If amber bottles are not available, protect samples from light. The container must be washed and muffled at 400°C before use, to minimize contamination.

5.2 Adsorption System

- 5.2.1 Dohrmann Adsorption Module (AD-2), or equivalent, pressurized, sample and nitrate-wash reservoirs.
- 5.2.2 Adsorption columns - pyrex, 5 cm long X 6-mm OD X 2-mm ID.
- 5.2.3 Granular Activated Carbon (GAC) - Filtrasorb-400, Calgon-APC, or equivalent, ground or milled, and screened to a 100/200 mesh range. Upon combustion of 40 mg of GAC, the apparent-halide background should be 1000-mg Cl^- equivalent or less.
- 5.2.4 Cerafelt (available from Johns-Manville), or equivalent - Form this material into plugs using a 2-mm ID stainless-steel borer with ejection rod (available from Dohrmann) to hold 40 mg of GAC in the adsorption columns. CAUTION: Do not touch this material with your fingers.
- 5.2.5 Column holders (available from Dohrman).
- 5.2.6 Volumetric flasks - 100-mL, 50-mL.

A general schematic of the adsorption system is shown in Figure 1.

5.3 Dohrmann microcoulometric-titration system (MCTS-20 or DX-20), or equivalent, containing the following components:

- 5.3.1 Boat sampler.
- 5.3.2 Pyrolysis furnace.
- 5.3.3 Microcoulometer with integrator.
- 5.3.4 Titration cell.

A general description of the analytical system is shown in Figure 2.

5.4 Strip-Chart Recorder.

6. Reagents

- 6.1 Sodium sulfite - 0.1 M, ACS reagent grade (12.6 g/L).
- 6.2 Nitric acid - concentrated.
- 6.3 Nitrate-Wash Solution (5000 mg NO_3^-/L) - Prepare a nitrate-wash solution by transferring approximately 8.2 gm of potassium nitrate into a 1-litre volumetric flask and diluting to volume with reagent water.
- 6.4 Carbon dioxide - gas, 99.9% purity.
- 6.5 Oxygen - 99.9% purity.
- 6.6 Nitrogen - prepurified.
- 6.7 70% Acetic acid in water - Dilute 7 volumes of acetic acid with 3 volumes of water.
- 6.8 Trichlorophenol solution, stock (1 μL = 10 $\mu\text{g Cl}^-$) - Prepare a stock solution by weighing accurately 1.856 gm of trichlorophenol into a 100-mL volumetric flask. Dilute to volume with methanol.
- 6.9 Trichlorophenol solution, calibration (1 μL = 500 ng Cl^-) - Dilute 5 mL of the trichlorophenol stock solution to 100 mL with methanol.
- 6.10 Trichlorophenol standard, instrument-calibration - First, nitrate wash a single column packed with 40 mg of activated carbon as instructed for sample analysis, and then inject the column with 10 μL of the calibration solution.
- 6.11 Trichlorophenol standard, adsorption-efficiency (100 $\mu\text{g Cl}^-/\text{L}$) - Prepare a adsorption-efficiency standard by injecting 10 μL of stock solution into 1 liter of reagent water.
- 6.12 Reagent water - Reagent water is defined as a water in which an

interferent is not observed at the method detection limit of each parameter of interest.

6.13 Blank standard - The reagent water used to prepare the calibration standard should be used as the blank standard.

7. Calibration

7.1 Check the adsorption efficiency of each newly-prepared batch of carbon by analyzing 100 mL of the adsorption-efficiency standard, in duplicate, along with duplicates of the blank standard. The net recovery should be within 5% of the standard value.

7.2 Nitrate-wash blanks (Method Blanks) - Establish the repeatability of the method background each day by first analyzing several nitrate-wash blanks. Monitor this background by spacing nitrate-wash blanks between each group of eight pyrolysis determinations.

7.2.1 The nitrate-wash blank values are obtained on single columns packed with 40 mg of activated carbon. Wash with the nitrate solution as instructed for sample analysis, and then pyrolyze the carbon.

7.3 Pyrolyze duplicate instrument-calibration standards and the blank standard each day before beginning sample analysis. The net response to the calibration-standard should be within 3% of the calibration-standard value. Repeat analysis of the instrument-calibration standard after each group of eight pyrolysis determinations, and before resuming sample analysis after cleaning or reconditioning the titration cell or pyrolysis system.

8. Sample Preparation

8.1 Special care should be taken in the handling of the sample to

minimize the loss of volatile organohalides. The adsorption procedure should be performed simultaneously on duplicates.

- 8.2 Reduce residual chlorine by the addition of sulfite (1 mL of 0.1 M per liter of sample). Addition of sulfite should be done at the time of sampling if the analysis is meant to determine the TOX concentration at the time of sampling. It should be recognized that TOX may increase on storage of the sample. Samples should be stored at 4°C without headspace.
- 8.3 Adjust pH of the sample to approximately 2 with concentrated HNO_3 just prior to adding the sample to the reservoir.

9. Adsorption Procedure

- 9.1 Connect two columns in series, each containing 40 mg of 100/200-mesh activated carbon.
- 9.2 Fill the sample reservoir, and pass a metered amount of sample through the activated-carbon columns at a rate of approximately 3 mL/min. NOTE: 100 mL of sample is the preferred volume for concentrations of TOX between 5 and 500 $\mu\text{g/L}$; 50 mL for 501 to 1000 $\mu\text{g/L}$, and 25 mL for 1001 to 2000 $\mu\text{g/L}$.
- 9.3 Wash the columns-in-series with 2 mL of the 5000-mg/L nitrate solution at a rate of approximately 2 mL/min to displace inorganic chloride ions.

10. Pyrolysis Procedure

- 10.1 The contents of each column is pyrolyzed separately. After rinsing with the nitrate solution, the columns should be protected from the atmosphere and other sources of contamination until ready for further analysis.

10.2 Pyrolysis of the sample is accomplished in two stages. The volatile components are pyrolyzed in a CO_2 -rich atmosphere at a low temperature to assure the conversion of brominated trihalomethanes to a titratable species. The less volatile components are then pyrolyzed at a high temperature in an O_2 -rich atmosphere.

NOTE: The quartz sampling boat should have been previously muffled at 800°C for at least 2 to 4 minutes as in a previous analysis, and should be cleaned of any residue by vacuuming.

10.3 Transfer the contents of each column to the quartz boat for individual analysis.

10.4 If the Dohrmann MC-1 is used for pyrolysis, manual instructions are followed for gas flow regulation. If the MCT-20 is used, the information on the diagram in Figure 3 is used for gas flow regulation.

10.5 Position the sample for 2 minutes in the 200°C zone of the pyrolysis tube. For the MCTS-20, the boat is positioned just outside the furnace entrance.

10.6 After 2 minutes, advance the boat into the 800°C zone (center) of the pyrolysis furnace. This second and final stage of pyrolysis may require from 6 to 10 minutes to complete.

11. Detection

The effluent gases are directly analyzed in the microcoulometric-titration cell. Carefully follow manual instructions for optimizing cell performance.

12. Breakthrough

Because the background bias can be of such an unpredictable nature, it can be especially difficult to recognize the extent of breakthrough of organohalides from one column to another. All second-column measurements for a properly operating system should not exceed 10-percent of the two-column total measurement. If the 10-percent figure is exceeded, one of three events can have happened. Either the first column was overloaded and a legitimate measure of breakthrough was obtained - in which case taking a smaller sample may be necessary; or channeling or some other failure occurred - in which case the sample may need to be rerun; or a high, random, bias occurred and the result should be rejected and the sample rerun. Because knowing which event has occurred may not be possible, a sample analysis should be repeated often enough to gain confidence in results. As a general rule, any analyses that is rejected should be repeated whenever sample is available. In the event that the second-column measurement is equal to or less than the nitrate-wash blank value, the second-column value should be disregarded.

13. Quality Control

- 13.1 Before performing any analyses, the analyst must demonstrate the ability to generate acceptable accuracy and precision with this procedure by the analysis of appropriate quality-control check samples.
- 13.2 The laboratory must develop and maintain a statement of method accuracy for their laboratory. The laboratory should update the accuracy statement regularly as new recovery measurements are made.

13.3 It is recommended that the laboratory adopt additional quality-assurance practices for use with this method. The specific practices that would be most productive will depend upon the needs of the laboratory and the nature of the samples. Field duplicates may be analyzed to monitor the precision of the sampling technique. Whenever possible, the laboratory should perform analysis of standard reference materials and participate in relevant performance-evaluation studies.

14. Calculations

OX as Cl^- is calculated using the following formula:

$$\frac{(C_1 - C_3) + (C_2 - C_3)}{V} = \mu\text{g/L Total Organic Halide}$$

where:

C_1 = $\mu\text{g Cl}^-$ on the first column in series

C_2 = $\mu\text{g Cl}^-$ on the second column in series

C_3 = predetermined, daily, average, method-blank value
(nitrate-wash blank for a 40-mg carbon column)

V = the sample volume in L

15. Accuracy and Precision

These procedures have been applied to a large number of drinking-water samples. The results of these analysis are summarized in Tables I and II.

16. Reference

Dressman, R., Najar, G., Redzikowski, R., paper presented at the Proceedings of the American Water Works Association Water Quality Technology Conference, Philadelphia, Dec. 1979.

TABLE I
PRECISION AND ACCURACY DATA FOR MODEL COMPOUNDS

Model Compound	Dose ug/L	Dose as ug/L Cl	Average % Recovery	Standard Deviation	No. of Replicates
CHCl ₃	98	88	89	14	10
CHBrCl ₂	160	106	98	9	11
CHBr ₂ Cl	155	79	86	11	13
CHBr ₃	160	67	111	8	11
Pentachlorophenol	120	80	93	9	7

TABLE II
PRECISION DATA ON TAP WATER ANALYSIS

Sample	Avg. halide ug Cl/L	Standard Deviation	No. of Replicates
A	71	4.3	8
B	94	7.0	6
C	191	6.1	4

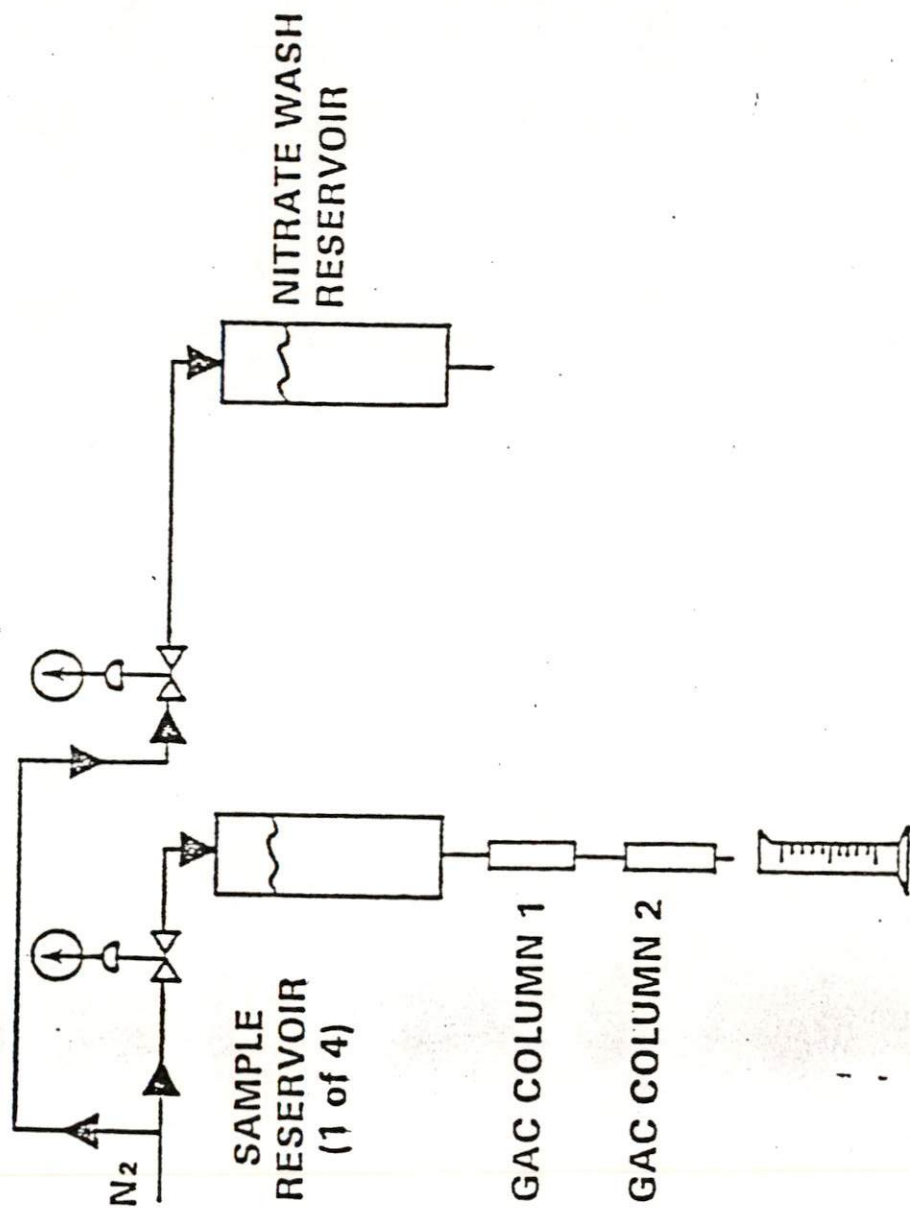


Figure 1. Adsorption Schematic

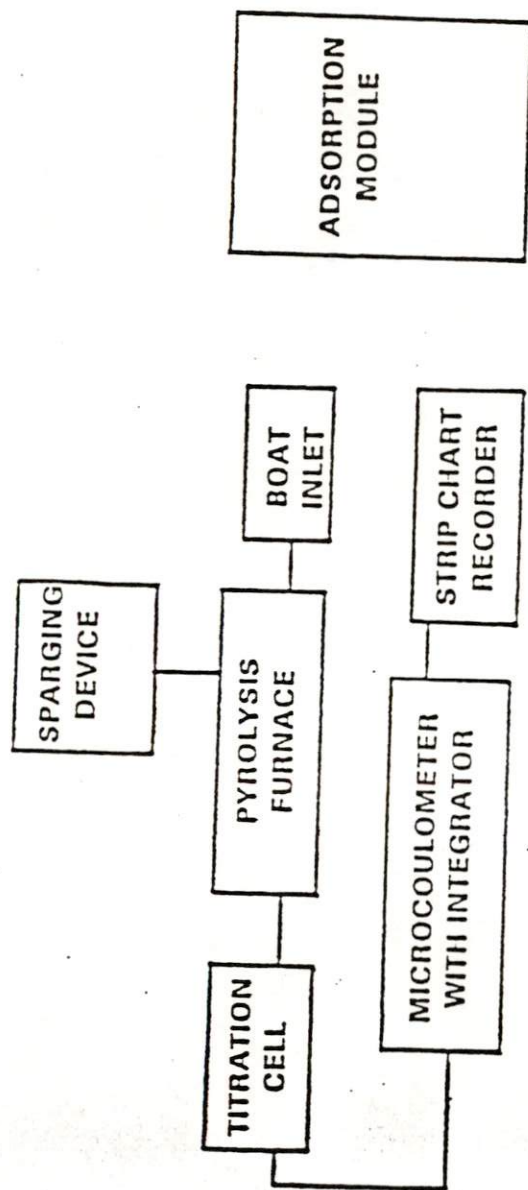


Figure 2. CAO Analysis System Schematic

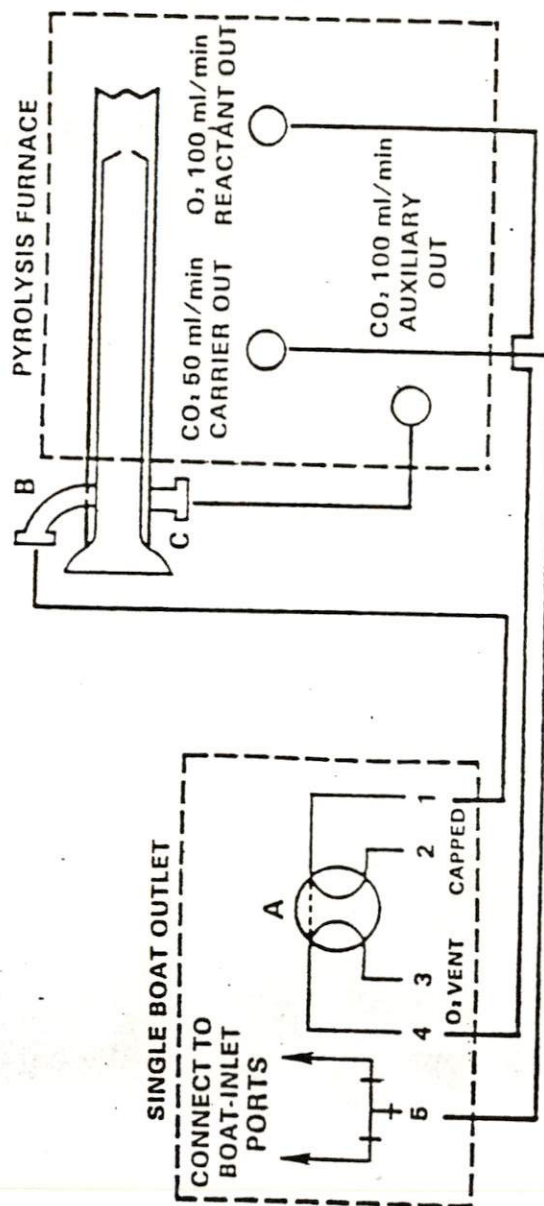


Figure 3. Rear view plumbing schematic for MCTS-20 system.
 Valve A is set for first-stage combustion, O₂ venting
 (push/pull valve out). Port B enters inner combustion
 tube; Port C enters outer combustion tube.

APPENDIX II

TOTAL ORGANIC CARBON, low level
(UV promoted, persulfate oxidation method)

STORET NO.
LOW LEVEL TOTAL

1. Scope and Application

- 1.1 This method covers the determination of total organic carbon in drinking water and other waters subject to the limitations in 1.3 and 5.1.
- 1.2 This instrument is designed for a two-step operation to distinguish between purgeable and nonpurgeable organic carbon. These separate values are not pertinent to this method.
- 1.3 This method is applicable only to that carbonaceous matter which is either soluble or has a particle size of 0.2 mm or less.
- 1.4 The applicable range is from approximately 50 ug/l to 10 mg/l. Higher concentrations may be determined by sample dilution.

2. Summary of Method

A sample is combined with 1 ml of acidified persulfate reagent and placed in a sparger. The sample is purged with helium which transfers inorganic CO₂ and purgeable organics to a CO₂ scrubber. The CO₂ is removed with at least 99.9% efficiency with a 2.5-minute purge. The purgeable organics proceed through a reduction system where the gas stream is joined by hydrogen and passed over a nickel catalyst which converts the purgeable organic carbon to methane. The methane is measured by a flame ionization detector. The detector signal is integrated and displayed as the concentration of purgeable organic carbon.

The sample is then transferred to a quartz ultraviolet reaction coil where the nonpurgeable organics are subjected to intense ultraviolet illumination in the presence of the acidified persulfate reagent. The nonpurgeables are converted to CO₂ and transferred to a second sparger where a helium purge transfers the CO₂ to the reduction system and into the detector. The signal is integrated, added to the purgeable organic carbon value, and displayed as the concentration of total organic carbon.

3. Definitions

- 3.1. Total organic carbon measured by this procedure is the sum of the purgeable organic carbon and the nonpurgeable organic carbon as defined in 3.2 and 3.3.
- 3.2 Purgeable organic carbon is the organic carbon matter that is transferred to the gas phase when the sample is purged with helium and which passes through the CO₂ scrubber. The definition is instrument condition dependent.
- 3.3 Nonpurgeable organic carbon is defined as that which remains after removal of the purgeable organic carbon from the sample containing acidified persulfate reagent and which is converted to CO₂ under the instrument conditions.
- 3.4 The system blank is the value obtained in 8.2 for an irradiated, recirculated reagent distilled water sample.

4. Sample Handling and Preservation

- 4.1 Sampling and storage of samples must be done in glass bottles. Caution: Do not leave any headspace in the sample bottle as this may contribute to loss of purgeable organics.
- 4.2 Because of the possibility of oxidation or bacterial decomposition of some components of aqueous samples, the lapse of time between collection of samples and start of analysis should be kept to a minimum. Also, samples should be kept cool (4°C) and protected from sunlight and atmospheric oxygen.
- 4.3 When analysis cannot be performed within two hours from time of sampling, the sample should be acidified to pH 2 with H₂SO₄. Note: HCl should not be used because it is converted to chlorine during the analysis. This causes damage to the instrument.

5. Interferences

- 5.1 If a sample is homogenized to reduce the size of the particulate matter, the homogenizing may cause loss of purgeable organic carbon, thus yielding erroneously low results.

6. Apparatus

- 6.1 Apparatus for blending or homogenizing samples: a household blender or similar device that will reduce particles in the sample to less than 0.2 mm.

6.2 Apparatus for Total Organic Carbon: The essential components for the apparatus used in this method are: A sparge assembly, flow switching valves, a pyrolysis furnace, quartz ultraviolet reactor coil, reducing column, flame ionization detector, electrometer and integrator. This method is based on the Dohrmann Envirotech DC-54 Carbon Analyzer. Other instruments having similar performance characteristics may be used.

6.3 Sampling Devices - Any apparatus that will reliably transfer 10 ml of sample to the sparger. A 50 ml glass syringe is recommended when analyzing samples with easily purgeable organics so as to minimize losses.

7. Reagents

7.1 Reagent Distilled Water: Distilled water used in preparation of standards and for dilution of samples should be ultra-pure to reduce the magnitude of the blank. Carbon dioxide-free, double distilled water is recommended. The water should be distilled from permanganate or be obtained from a system involving distillation and carbon treatment. The reagent distilled water value must be compared to a system blank determined on a recirculated distilled water sample. The total organic carbon value of the reagent distilled water should be less than 60 ug/l. Purgeable organic carbon values of the reagent distilled water should be less than 4 ug/l.

7.2 Potassium hydrogen phthalate, stock solution, 500 mg carbon/liter: Dissolve 1.063 g of potassium hydrogen phthalate (Primary Standard Grade) in reagent distilled water (7.1) and dilute to 1 liter.

7.3 Potassium hydrogen phthalate (2 mg/l): Pipet 4 ml of potassium hydrogen phthalate stock solution (7.2) into a one liter volumetric flask and dilute to the mark with reagent distilled water (7.1).

7.4 Potassium hydrogen phthalate (5 mg/l): Pipet 1 ml of potassium hydrogen phthalate stock solution (7.2) into a 100 ml volumetric flask and dilute to the mark with reagent distilled water (7.1).

7.5 Potassium hydrogen phthalate (10 mg/l): Pipet 2 ml of potassium hydrogen phthalate stock solution (7.2) into a 100 ml volumetric flask and dilute to the mark with reagent distilled water (7.1).

7.6 Acidified Persulfate Reagent - Place 100 ml of reagent distilled water (7.1) in a container. Add 5 g of potassium persulfate. Add 5 g (3 ml) of concentrated (85%) phosphoric acid.

- 7.7 Carbonate-bicarbonate, stock solution, 1000 mg carbon/liter: Place 0.3500 g of sodium bicarbonate and 0.4418 g of sodium carbonate in a 100 ml volumetric flask. Dissolve with reagent distilled water (7.1) and dilute to the mark.
- 7.8 Carbonate-bicarbonate, standard solution 50 mg/l: Place 5 ml of the carbonate-bicarbonate stock solution in a 100 ml volumetric flask and dilute to the mark with reagent distilled water (7.1).

8. Procedure

- 8.1 Allow at least 30 minutes warm-up time. Leave instrument console on continuously when in daily use, except for the ultra-violet light source, which should be turned off when not in use for more than a few hours.
- 8.2 Adjust all gas flows, temperatures and cycle times to manufacturer's specifications. Perform the "System Cleanup and Calibration" procedure in the manufacturer's specifications each day. Recirculate a sample of irradiated distilled water until two consecutive readings within 10% of each other are obtained. Record the last value for the system blank. This value is a function of the total instrument operation and should not vary significantly from previous runs. Reasons for significant changes in the value should be identified.
- 8.3 Check the effectiveness of the CO₂ scrubber by analyzing the carbonate-bicarbonate standard solution (7.8). Add 1 ml of acidified persulfate reagent (7.6) to 50 ml of the solution. Transfer 10 ml of the solution-with-reagent to the first sparger and start the analysis cycle. No response, or a very minor reading, should be obtained from this solution.
- 8.4 Add 1 ml of acidified persulfate reagent (7.6) to 50 ml of reagent distilled water (7.1) blank, standards 7.3, 7.4, and 7.5 and the samples.
- 8.5.1 Run the reagent distilled water (7.1) and 5.0 mg/l standard (7.4):

Transfer 10 ml of the solution-with-reagent to the first sparger and start analyzer cycle

Ignore the meter reading for the first cycle

Transfer a second 10 ml of the solution-with-reagent to the first sparger and start the analysis cycle

Record the meter reading (see 9.1) of the final carbon value for each of the reagent distilled water (7.1) and the standard (7.4).

If the meter reading is more than 25% above or below the calculated value of standard 7.4, reanalyze the standard and set the calibration within 25% (8.5.4), reanalyze the system blank, and then begin 8.5.1 again. If the meter reading (see 9.1) is within 25% of the calculated value, continue to next step. The calculated value is defined in 8.5.2.

- 8.5.2 Calculate the factor for the deviation of the instrument reading (see 9.1) for the standard (7.4) from the calculated value by:

$$\frac{\text{standard reading} - \text{calculated value}}{\text{calculated value}} = \text{FACTOR}$$

where the calculated value is that value obtained by using the weight of potassium hydrogen phthalate and does not include the carbon contributed by the reagent distilled water (7.1) with which it has been diluted.

- 8.5.3 Calculate the adjusted reading by:

$$\text{calculated value} + (\text{RDW} - (\text{FACTOR} \times \text{RDW})) = \text{ADJUSTED READING.}$$

where RDW = mean reagent distilled water (7.1) value.

- 8.5.4 Push in CALIBRATE button after READY light comes on and adjust the SPAN control to the ADJUSTED READING calculated in 8.5.3.

- 8.6 Analyze the standards 7.3 and 7.5 in order to check the linearity of the instrument at least once each day:

Transfer 10 ml of the solution-with-reagent to the first sparger and start analyzer cycle

Ignore the meter reading for the first cycle

Transfer a second 10 ml of the solution-with-reagent to the first sparger and start the analyzer cycle

Record the meter reading (see 9.1) of the final carbon value for each of the standards 7.3 and 7.5.

The range of concentration used for calibrating the instrument and checking the linearity of the instrument should be ascertained from a knowledge of the range of concentrations expected from the samples. Standards for lower ranges can be prepared by diluting standards 7.2, 7.3, and 7.4.

- 8.7 Analyze the samples. Transfer 10 ml of sample with reagent to the first sparger and start the analysis cycle.

Transfer 10 ml of the solution-with-reagent to the first sparger and start analyzer cycle

Ignore the meter reading for the first cycle

Transfer a second 10 ml of the solution-with-reagent to the first sparger and start the analyzer cycle

Record the meter reading (see 9.1) of the final carbon value for each of the samples.

9. Calculations

- 9.1 The values are read off the final digital readout in ug/l. The system blank reading obtained in 8.2 must be subtracted from all reagent distilled water, standard and sample readings.

10. Precision and Accuracy

- 10.1 In a single laboratory (MERL), using raw river water, centrifuged river water, drinking water, and the effluent from a carbon column which had concentrations of 3.11, 3.10, 1.79, and 0.07 mg/l total organic carbon respectively, the standard deviations from ten replicates were ± 0.13 , ± 0.03 , ± 0.02 , and ± 0.02 mg/l, respectively.
- 10.2 In a single laboratory (MERL), using potassium hydrogen phthalate in distilled water at concentrations of 5.0 and 1.0 mg/l total organic carbon, recoveries were 80% and 91%, respectively.

11. References

- 11.1 Proposed Standard Method for Purgeable and Nonpurgeable Organic Carbon in Water (UV-promoted, persulfate oxidation method). ASTM Committee D-19, Task Group 19.06.02.03 (Chairman R. J. Joyce), January 1978.
- 11.2 Operating Instruction Dohrmann Envirotech, 3420 Scott Boulevard, Santa Clara, California 95050.
- 11.2 Takahashi, Y., "Ultra Low Level TOC Analysis of Potable Waters." Presented at Water Quality Technology Conference, AWWA, Dec. 5-8, 1976.

METHOD FOR CHLORINATED HYDROCARBONS IN WATER AND WASTEWATER

1. Scope and Application

- 1.1 This method covers the determination of various organo-chlorine pesticides and heptachlor epoxide in water and wastewater.
- 1.2 The following pesticides may be determined individually by this method:

<u>Parameter</u>	<u>Storet No.</u>
Aldrin	39330
BHC	----
Captan	39640
Chlordane	39350
DDD	39360
DDE	39365
DDT	39370
Dichloran	----
Dieldrin	39380
Endosulfan	39388
Endrin	39390
Heptachlor	39410
Lindane	39782
Methoxychlor	39480
Mirex	39755
PCNB	39029
Strohan	----
Toxaphene	39400
Trifluralin	39030

- 1.3 The following chlorinated organic compound may be determined individually by this method:

<u>Compound</u>	<u>Storet No.</u>
Heptachlor epoxide	----

2. Summary

- 2.1 The method offers several analytical alternatives, dependent on the analyst's assessment of the nature and extent of interferences and/or the complexity of the pesticide mixtures found. Specifically, the procedure describes the use of an effective co-solvent for efficient sample extraction; provides, through use of column chromatography and liquid-liquid partition, methods for elimination of non-pesticide interferences and the pre-separation of pesticide mixtures. Identification is made by selective gas chromatographic separations and may be corroborated through the use of two or more unlike columns. Detection and measurement is accomplished by electron capture, microcoulometric or electrolytic conductivity gas chromatography. Results are reported in micrograms per liter.
- 2.2 Confirmation of the identity of the compounds should be made by GC-MS when a new or undefined sample type is being analyzed and the concentration is adequate for such determination.
- 2.3 This method is recommended for use only by experienced pesticide analysts or under the close supervision of such qualified persons.

3. Interferences

- 3.1 Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines, causing misinterpretation of gas chromatograms.

All of these materials must be demonstrated to be free from interferences under the conditions of the analysis. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required. Refer to Appendix I.

3.2 The interferences in industrial effluents are high and varied and often pose great difficulty in obtaining accurate and precise measurement of organochlorine pesticides. Sample clean-up procedures are generally required and may result in the loss of certain organochlorine pesticides. Therefore, great care should be exercised in the selection and use of methods for eliminating or minimizing interferences. It is not possible to describe procedures for overcoming all of the interferences that may be encountered in industrial effluents.

3.3 Polychlorinated Biphenyls (PCBs) - Special attention is called to industrial plasticizers and hydraulic fluids such as the PCBs, which are a potential source of interference in pesticide analysis. The presence of PCBs is indicated by a large number of partially resolved or unresolved peaks which may occur throughout the entire chromatogram. Particularly severe PCB interference will require special separation procedures (1, 2).

3.4 Phthalate Esters - These compounds, widely used as plasticizers, respond to the electron capture detector and are a source of interference in the determination of organochlorine pesticides using this detector. Water leaches these materials from plastics, such as polyethylene bottles and tygon tubing.

The presence of phthalate esters is implicated in samples that respond to electron capture but not to the microcoulometric or electrolytic conductivity halogen detectors or to the flame photometric detector.

- 3.5 Organophosphorus Pesticides - A number of organophosphorus pesticides, such as those containing a nitro group, e.g., parathion, also respond to the electron capture detector and may interfere with the determination of the organochlorine pesticides. Such compounds can be identified by their response to the flame photometric detector (3).

4. Apparatus and Materials

- 4.1 Gas Chromatograph - Equipped with glass lined injection port.

4.2 Detector Options:

4.2.1 Electron Capture - Radioactive (tritium or nickel-63)

4.2.2 Microcoulometric Titration

4.2.3 Electrolytic Conductivity

- 4.3 Recorder - Potentiometric strip chart (10 in.) compatible with the detector.

4.4 Gas Chromatographic Column Materials:

4.4.1 Tubing - Pyrex (180 cm long X 4 mm ID)

4.4.2 Glass Wool - Silanized

4.4.3 Solid Support - Gas-Chrom-Q (100-120 mesh)

4.4.4 Liquid Phases - Expressed as weight percent coated on solid support.

4.4.4.1 OV-1, 3%

4.4.4.2 OV-210, 5%

4.4.4.3 OV-17, 1.5% plus QF-1 or OV-210, 1.95%

4.4.4.4 QF-1, 6% plus SE-30, 4%

4.5 Kuderna-Danish (K-D) Glassware

4.5.1 Snyder Column - three-ball (macro) and two-ball (micro)

4.5.2 Evaporative Flasks - 500 ml

4.5.3 Receiver Ampuls - 10 ml, graduated

4.5.4 Ampul Stoppers

4.6 Chromatographic Column - Chromaflex (400 mm long x 19 mm ID) with coarse fritted plate on bottom and Teflon stopcock; 250-ml reservoir bulb at top of column with flared out funnel shape at top of bulb - a special order (Kontes K-420540- 9011).

4.7 Chromatographic Column - pyrex (approximately 400 mm long x 20 mm ID) with coarse fritted plate on bottom.

4.8 Micro Syringes - 10, 25, 50 and 100 μ l.

4.9 Separatory funnels - 125 ml, 1000 ml and 2000 ml with Teflon stopcock.

4.10 Blender - High speed, glass or stainless steel cup.

4.11 Graduated cylinders - 100 and 250 ml.

4.12 Florisil - PR Grade (60-100 mesh); purchase activated at 1250⁰F and store in the dark in glass containers with glass stoppers or foil-lined screw caps. Before use, activate each batch overnight at 130⁰C in foil-covered glass container. Determine lauric-acid value (See Appendix II).

Reagents, Solvents, and Standards

5.1 Sodium Chloride - (ACS) Saturated solution in distilled water

(pre-rinse NaCl with hexane).

- 5.2 Sodium Hydroxide - (ACS) 10 N in distilled water.
- 5.3 Sodium Sulfate - (ACS) Granular, anhydrous (conditioned at 400 C for 4 hrs.).
- 5.4 Sulfuric Acid - (ACS) Mix equal volumes of conc. H_2SO_4 with distilled water.
- 5.5 Diethyl Ether - Nanograde, redistilled in glass, if necessary.
 - 5.5.1 Must be free of peroxides as indicated by EM Quant test strips. (Test strips are available from EM Laboratories, Inc., 500 Executive Blvd., Elmsford, N.Y. 10523.)
 - 5.5.2 Procedures recommended for removal of peroxides are provided with the test strips.
- 5.6 Acetonitrile, Hexane, Methanol, Methylene Chloride, Petroleum Ether (boiling range 30-60°C) - nanograde, redistill in glass if necessary.
- 5.7 Pesticide Standards - Reference grade.

6. Calibration

- 6.1 Gas chromatographic operating conditions are considered acceptable if the response to dicapthon is at least 50% of full scale when ≤ 0.06 ng is injected for electron capture detection and ≤ 100 ng is injected for microcoulometric or electrolytic conductivity detection. For all quantitative measurements, the detector must be operated within its linear response range and the detector noise level should be less than 2% of full scale.
- 6.2 Standards are injected frequently as a check on the stability of operating conditions. Gas chromatograms of several standard

pesticides are shown in Figures 1, 2, 3 and 4 and provide reference operating conditions for the four recommended columns.

6.3 The elution order and retention ratios of various organo-chlorine pesticides are provided in Table 1, as a guide.

7. Quality Control

7.1 Duplicate and spiked sample analyses are recommended as quality control checks. Quality control charts (4) should be developed and used as a check on the analytical system. Quality control check samples and performance evaluation samples should be analyzed on a regular basis.

7.2 Each time a set of samples is extracted, a method blank is determined on a volume of distilled water equivalent to that used to dilute the sample.

Sample Preparation

8.1 The sample size taken for analysis is dependent on the type of sample and the sensitivity required for the purpose at hand. Background information on the pesticide levels previously detected at a given sampling site will assist in determining the sample size required, as well as the final volume to which the extract needs to be concentrated. A 1-liter sample is usually taken for drinking water and ambient water analysis to provide a detection limit of 0.050 to 0.100 $\mu\text{g/l}$. One-hundred milliliters is usually adequate to provide a detection limit of 1 $\mu\text{g/l}$ for industrial effluents.

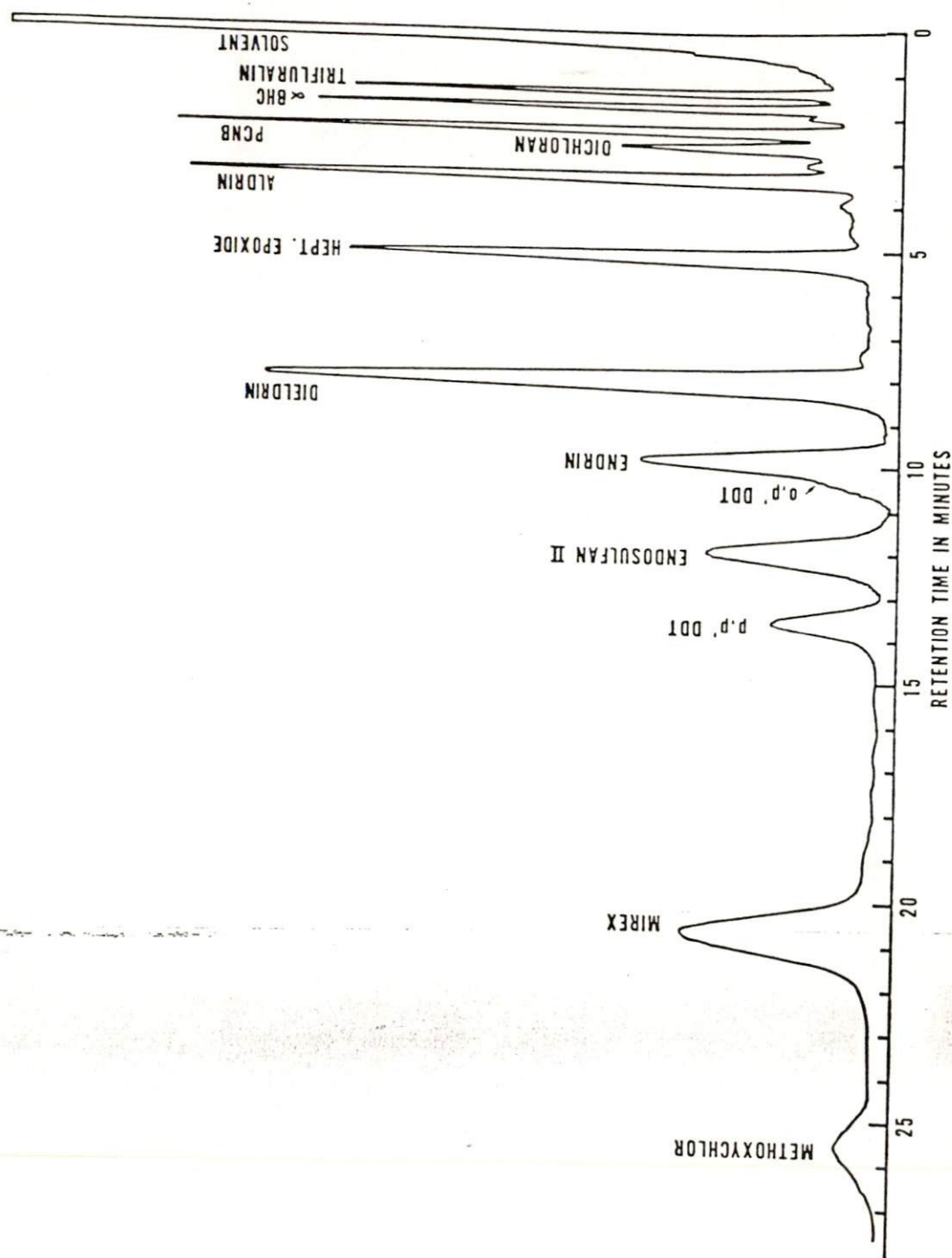


Figure 1. Column Packing: 1.5% OV-17 + 1.95% QF-1, Carrier Gas: Argon/Methane at 60 ml/min, Column Temperature: 200 C, Detector: Electron Capture.

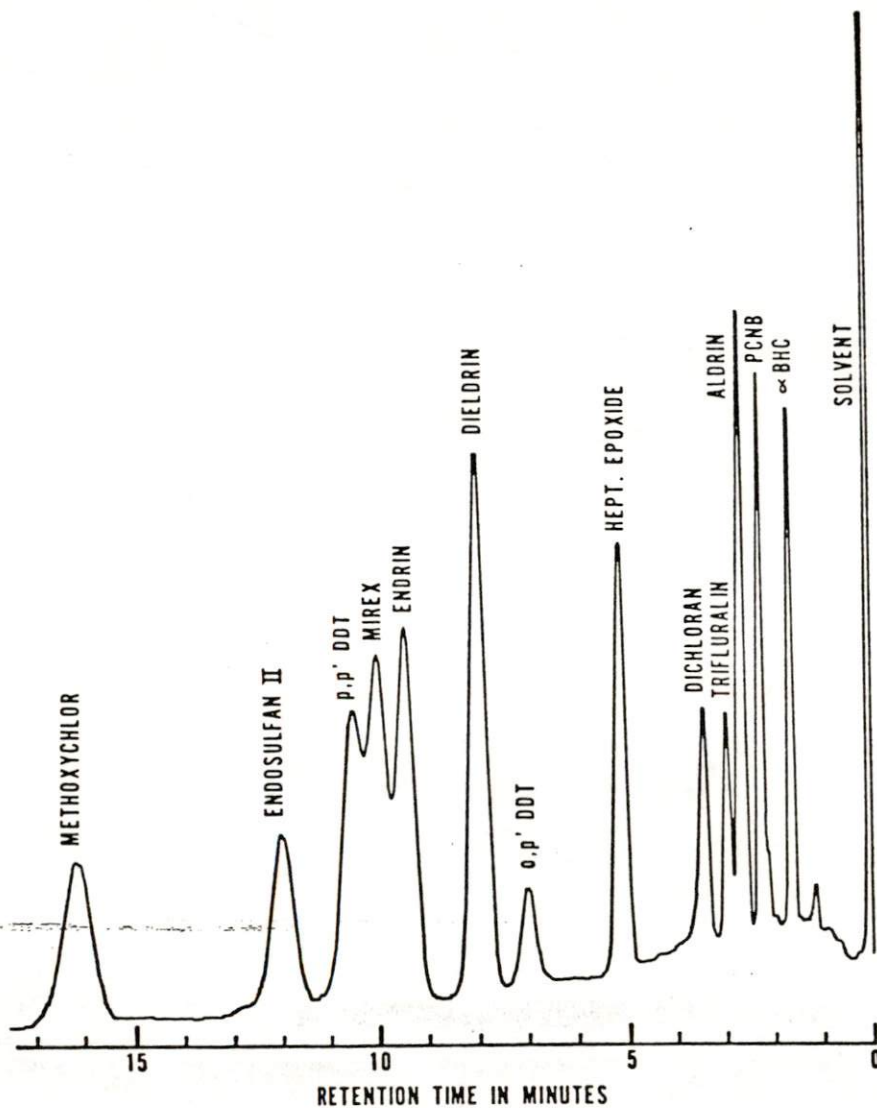


Figure 2. Column Packing: 5% OV-210, Carrier Gas: Argon/Methane at 70 ml/min, Column Temperature: 180 C, Detector: Electron Capture.

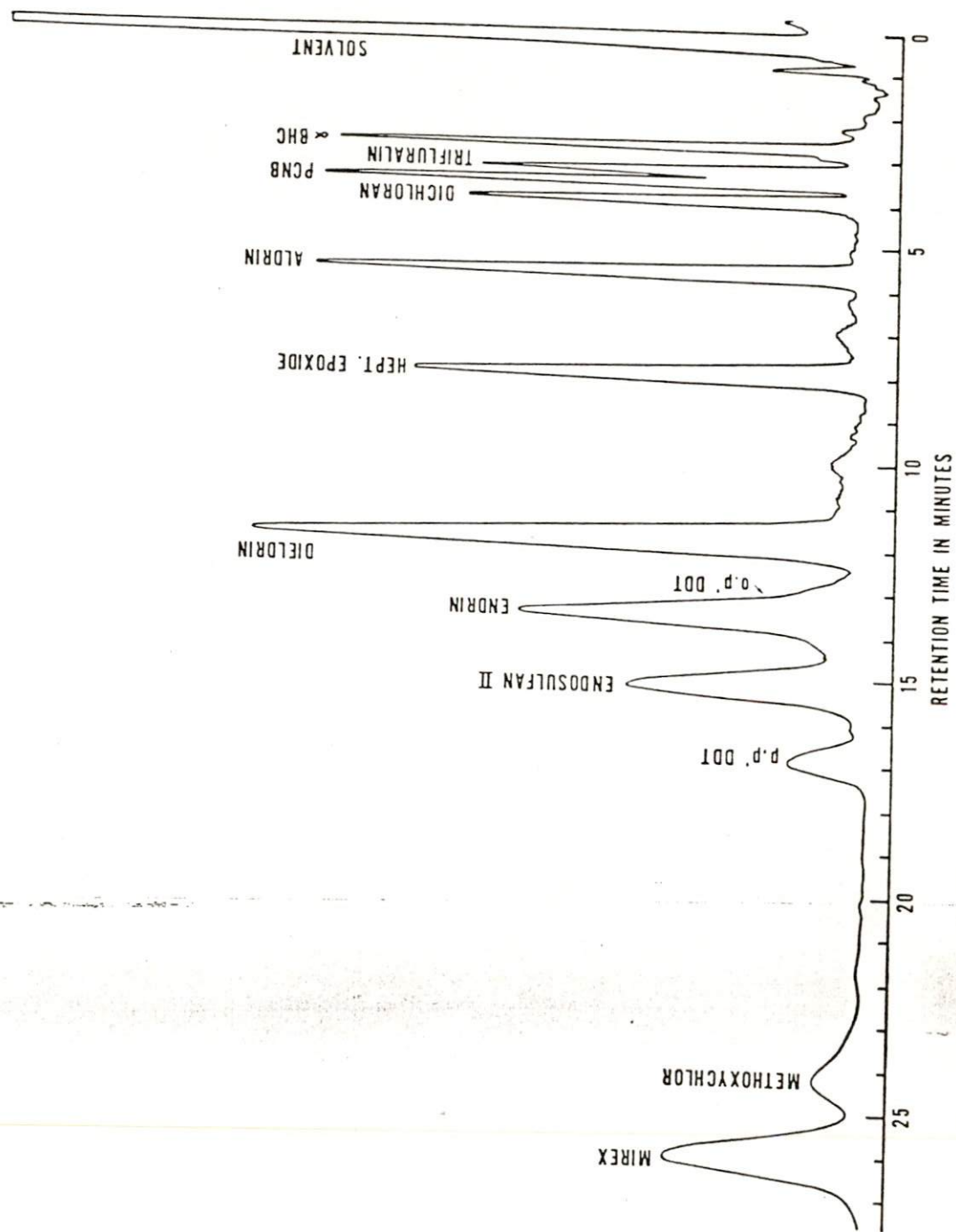


Figure 3. Column Packing: 6% QF-1 + 4% SE-30, Carrier Gas: Argon/Methane at 60 ml/min, Column Temperature: 200 C, Detector: Electron Capture.

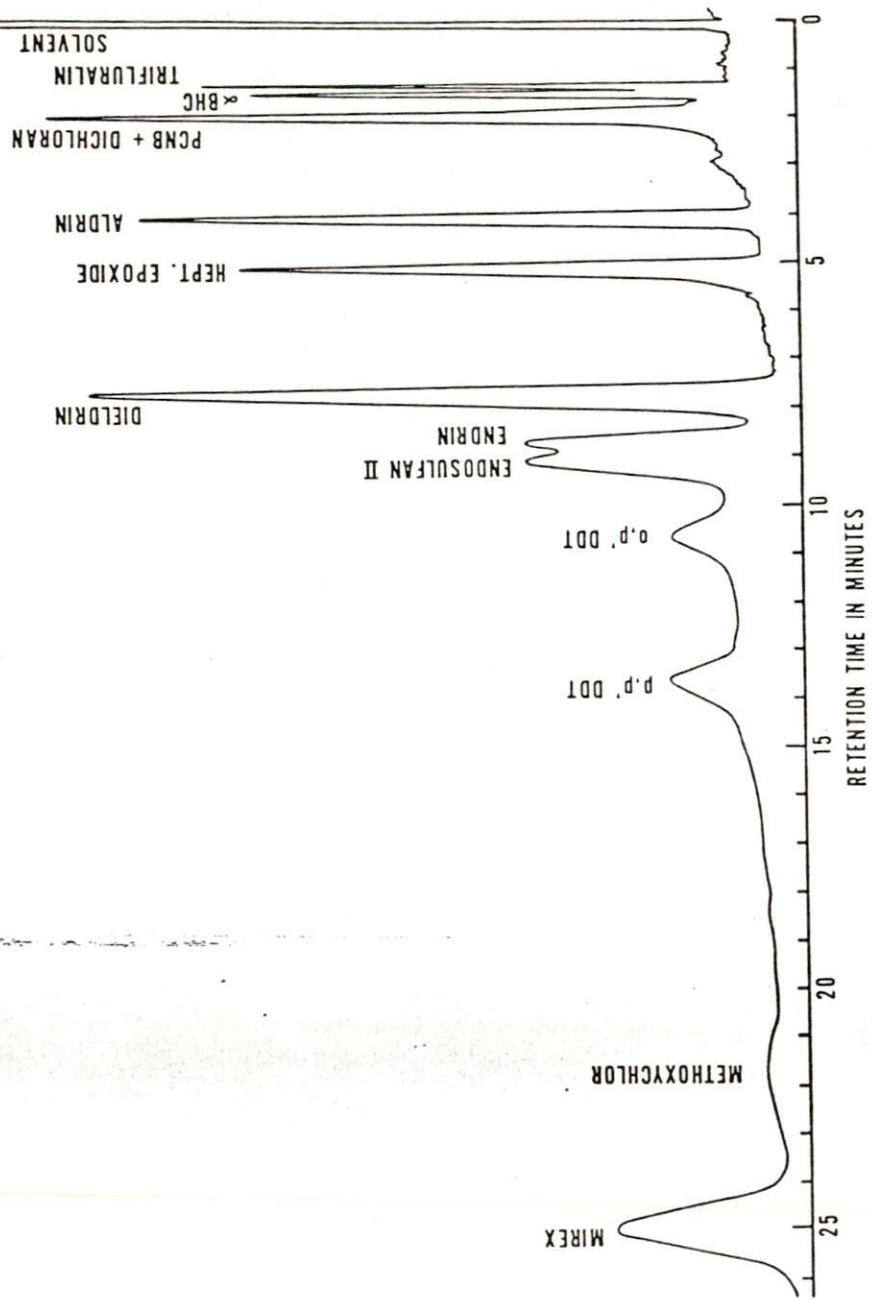


Figure 4. Column Packing: 3% OV-1, Carrier Gas: Argon/Methane at 70 ml/min,
Column Temperature: 180 C, Detector: Electron Capture.

Table 1
RETENTION RATIOS OF VARIOUS ORGANOCHLORINE PESTICIDES RELATIVE TO ALDRIN

Liquid Phase ¹	1.5% OV-17 + 1.95% QF-1 ²	5% OV-210	3% OV-1	6% QF-1 + 4% SE-30
Column Temp.	200 C	180 C	180 C	200 C
Argon/Methane Carrier Flow	60 ml/min	70 ml/min	70 ml/min	60 ml/min
Pesticide	RR	RR	RR	RR
Trifluralin	0.39	1.11	0.33	0.57
α -BHC	0.54	0.64	0.35	0.49
PCNB	0.68	0.85	0.49	0.63
Lindane	0.69	0.81	0.44	0.60
Dichloran	0.77	1.29	0.49	0.70
Heptachlor	0.82	0.87	0.78	0.83
Aldrin	1.00	1.00	1.00	1.00
Heptachlor Epoxide	1.54	1.93	1.28	1.43
Endosulfan I	1.95	2.48	1.62	1.79
p,p'-DDE	2.23	2.10	2.00	1.82
Dieldrin	2.40	3.00	1.93	2.12
Captan	2.59	4.09	1.22	1.94
Endrin	2.93	3.56	2.18	2.42
o,p'-DDT	3.16	2.70	2.69	2.39
p,p'-DDD	3.48	3.75	2.61	2.55
Endosulfan II	3.59	4.59	2.25	2.72
p,p'-DDT	4.18	4.07	3.50	3.12
Mirex	6.1	3.78	6.6	4.79
Methoxychlor	7.6	6.5	5.7	4.60
Aldrin (Min. absolute)	3.5	2.6	4.0	5.6

¹All columns glass, 180 cm x 4 mm ID, solid support Gas-Chrom Q (100/120 mesh)

²OV-210 also may be used

- 8.2 Quantitatively transfer the proper aliquot of sample from the sample container into a two-liter separatory funnel. If less than 800 ml is analyzed, dilute to one liter with interference free distilled water.

9. Extraction

- 9.1 Add 60 ml of 15% methylene chloride in hexane (v:v) to the sample in the separatory funnel and shake vigorously for two minutes.
- 9.2 Allow the mixed solvent to separate from the sample, then draw the water into a one-liter Erlenmeyer flask. Pour the organic layer into a 100 ml beaker and then pass it through a column containing 3-4 inches of anhydrous sodium sulfate, and collect it in a 500 ml K-D flask equipped with a 10 ml ampul. Return the water phase to the separatory funnel. Rinse the Erlenmeyer flask with a second 60-ml volume of solvent; add the solvent to the separatory funnel and complete the extraction procedure a second time. Perform a third extraction in the same manner.
- 9.3 Concentrate the extract in the K-D evaporator on a hot water bath.
- 9.4 Analyze by gas chromatography unless a need for cleanup is indicated (See Section 10).

10. Clean-up and Separation Procedures

- 10.1 Interferences in the form of distinct peaks and/or high background in the initial gas chromatographic analysis, as well as the physical characteristics of the extract (color, cloudiness, viscosity) and background knowledge of the sample will indicate

whether clean-up is required. When these interfere with measurement of the pesticides, or affect column life or detector sensitivity, proceed as directed below.

10.2 Acetonitrile Partition - This procedure is used to isolate fats and oils from the sample extracts. It should be noted that not all pesticides are quantitatively recovered by this procedure. The analyst must be aware of this and demonstrate the efficiency of the partitioning for specific pesticides. All of the pesticides listed in Scope (1.2) with the exception of mirex are efficiently recovered.

10.2.1 Quantitatively transfer the previously concentrated extract to a 125-ml separatory funnel with enough hexane to bring the final volume to 15 ml. Extract the sample four times by shaking vigorously for one minute with 30-ml portions of hexane-saturated acetonitrile.

10.2.2 Combine and transfer the acetonitrile phases to a one-liter separatory funnel and add 650 ml of distilled water and 40 ml of saturated sodium chloride solution. Mix thoroughly for 30-45 seconds. Extract with two 100-ml portions of hexane by vigorously shaking about 15 seconds.

10.2.3 Combine the hexane extracts in a one-liter separatory funnel and wash with two 100-ml portions of distilled water. Discard the water layer and pour the hexane layer through a 3-4 inch anhydrous sodium sulfate column into a 500-ml K-D flask equipped with a 10-ml

ampul. Rinse the separatory funnel and column with three 10-ml portions of hexane.

10.2.4 Concentrate the extracts to 6-10 ml in the K-D evaporator in a hot water bath.

10.2.5 Analyze by gas chromatography unless a need for further cleanup is indicated.

10.3 Florisil Column Adsorption Chromatography

10.3.1 Adjust the sample extract volume to 10 ml.

10.3.2 Place a charge of activated Florisil (weight determined by lauric-acid value, see Appendix II) in a Chromaflex column. After settling the Florisil by tapping the column, add about one-half inch layer of anhydrous granular sodium sulfate to the top.

10.3.3 Pre-elute the column, after cooling, with 50-60 ml of petroleum ether. Discard the eluate and just prior to exposure of the sulfate layer to air, quantitatively transfer the sample extract into the column by decantation and subsequent petroleum ether washings. Adjust the elution rate to about 5 ml per minute and, separately, collect up to three eluates in 500-ml K-D flasks equipped with 10-ml ampuls (see Eluate Composition 10.4.). Perform the first elution with 200 ml of 6% ethyl ether in petroleum ether, and the second elution with 200 ml of 15% ethyl ether in

petroleum ether. Perform the third elution with 200 ml of 50% ethyl ether - petroleum ether and the fourth elution with 200 ml of 100% ethyl ether.

10.3.4 Concentrate the eluates to 6-10 ml in the K-D evaporator in a hot water bath.

10.3.5 Analyze by gas chromatography.

10.4 Eluate Composition - By using an equivalent quantity of any batch of Florisil, as determined by its lauric acid value, the pesticides will be separated into the eluates indicated below:

<u>6% Eluate</u>		
Aldrin	DDT	Mirex
BHC	Heptachlor	PCNB
Chlordane	Heptachlor Epoxide	Strobane
DDD	Lindane	Toxaphene
DDE	Methoxychlor	Trifluralin
<u>15% Eluate</u>		<u>50% Eluate</u>
Endosulfan I		Endosulfan II
Endrin		Captan
Dieldrin		
Dichloran		

Certain thiophosphate pesticides will occur in each of the above fractions as well as the 100% fraction. For additional information regarding eluate composition, refer to the FDA Pesticide Analytical Manual (5).

11. Calculation of Results

11.1 Determine the pesticide concentration by using the absolute calibration procedure described below or the relative calibration procedure described in Appendix III.

(1) $\text{Micrograms/liter} = \frac{(A)}{(V_i)} \frac{(B)}{(V_s)} (V_t)$

A = $\frac{\text{ng standard}}{\text{Standard area}}$

B = Sample aliquot area

V_i = Volume of extract injected (μl)

V_t = Volume of total extract (μl)

V_s = Volume of water extracted (ml)

12. Reporting Results

12.1 Report results in micrograms per liter without correction for recovery data. When duplicate and spiked samples are analyzed, all data obtained should be reported.



INTER-OFFICE CORRESPONDENCE

To: K. S. Walborn

Date: March 20, 1984

From: C. J. Crawford

Location: Natrium Laboratory

Subject: Hg Pond RCRA Monitoring:
Analytical Methodology

The analytical protocol in support of groundwater testing for the mercury pond RCRA monitoring is shown below. Generally the procedures used to test the groundwater are those noted by Geraghty & Miller, Inc., in their 1981 report, "Sampling and Analysis Plan for the PPG Mercury Pond, Natrium, West Virginia."

The Environmental Group in the Technical Department schedules and takes the samples, then transports them to the Laboratory immediately after sampling. The Laboratory adds preservatives if needed and tests for the required parameters. Contract laboratories are used on occasion for some tests. Record keeping is a function of the Technical Department.

The attached table shows the test parameters, the selected approved analytical procedure, and the testing laboratory which is in current use for the mercury pond monitoring.

C. J. Crawford
C. J. Crawford

CJC/egm

cc: F. Abraham
R. F. Mitchell
Laboratory File

<u>Test Parameter</u>	<u>Test Method or Page No.</u>	<u>Source** of Method</u>	<u>Testing* Laboratory</u>
pH	239	1	1
Specific Conductance	275	1	1
TOC	ASTM-D-2579	2	1
TOX	450.1	5	2
Cl	29	1	1
SO ₄	277	1	1
Fe	200.1	4	1
Mn	200.1	4	1
Na	200.1	4	1
Phenol	241	1	2
SiO ₂	200.1	4	
Alkalinity CaCO ₃	403	3	1
Alkalinity HCO ₃	403	3	1
Color	36	1	1
TDS	266	1	1
Ca	200.1	4	1
Cu	200.1	4	1
K	200.1	4	1
Zn	200.1	4	1
Mg	200.1	4	1
V	200.1	4	1
Hg	118	1	1

TABLE CODES

* Testing Laboratories

- 1) Natrium Plant Control Laboratory
- 2) Kemron, Williamstown, West Virginia

** Source of Analytical Methods

- 1) Manual of Methods for Chemical Analysis of Water and Wastes; EPA-625-1-6-74-003a
- 2) ASTM-D-2579-; Dorchmann DC-80 Instructions
- 3) 15th Edition Standard Methods
- 4) EPA-600/4-79-020-200.7 (Replace ICAP with DCAP)
- 5) EPA-600/4-79-020



PPG Industries, Inc. One PPG Place Pittsburgh, Pennsylvania 15272

Law Department
Writer's Direct Dial No.:

(412) 434-2406

May 2, 1984

Ralph Siskind, Esq.
U. S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Dear Ralph:

At our meeting of April 2, 1984, PPG representatives expressed an interest in settling the EPA RCRA complaint without a formal hearing. EPA apparently shared this sentiment. Accordingly, at the end of that settlement conference, PPG agreed to submit a number of documents which EPA requested and to draft a proposed monitoring plan which would address the questions of the upgradient and downgradient wells and the parameters to be tested in view of the peculiar circumstances of PPG's mercury impoundment (e.g. erstwhile brine pond and lack of any water table upgradient).

It is still PPG's position that the enforcement action and the appurtenant fines are unwarranted. PPG made a good faith effort to comply with the regulations and hired Geraghty and Miller in 1980 to take advantage of that company's experience and expertise. PPG relied on the judgment and report of Geraghty and Miller and selected what PPG considered a reasonable monitoring program which complied with the RCRA requirements. As you know, in our informal settlement conference, there was disagreement even among EPA employees on the best location for an upgradient well. In fact, three EPA employees suggested two different approaches to the problem and three different locations for an upgradient well. In view of this, it is very difficult for PPG to accept a fine on the location of monitoring wells when the issue is so much one of judgment. This is especially true in light of PPG's having informed EPA of its use of the "reference" well in January of 1982, over two years before the complaint was filed.

The other basis of the complaint, the failure to comply with procedural notice requirements upon discovery of a statistically significant difference, was the subject of my letter to you dated April 3, 1984. At

May 2, 1984

that time, I sent you a detailed assessment plan which documents the basis of the final report submitted to EPA in December of 1983. The citation and fine are, in my opinion, the result of the unfortunate loss of the final report by EPA. Thus, EPA and PPG had completely different views on PPG's compliance with the regulations. I can understand EPA's perception that PPG was taking no action, but now that EPA is aware of what PPG and its consultant were doing, it should be willing to drop the fine. To the extent that there was any procedural or technical noncompliance, it was cured prior to the complaint's being filed.

A number of documents are included with this letter. These documents fall into two categories:

- A. Documents which reflect data or well logs which were requested by EPA.
- B. Documents which constitute a proposal for groundwater monitoring put together by PPG to satisfy the concerns of EPA and the state.

The documents in Section A, which are those requested by EPA at our meeting, are as follows:

- A-1 Core patterns for Brine Wells No. 1 and No. 2.
- A-2 Organics and TOC analyses for mercury pond.
- A-3 Analyses of perched water zones - Wells GM-3, GM-5 and GM-7.
- A-4 Excerpted sections of plantwide Geraghty and Miller report which discuss hydrologic conditions that might have an impact on the mercury impoundment site.

Please keep in mind that PPG's willingness to take additional steps on the monitoring does not constitute any admission that its current program violates any federal or state regulations. As I told you in our settlement conference, the RCRA groundwater program is an evolving program and we have learned a good deal about the groundwater at Natrium since our initial installation. The proposed program is submitted in the interest of settling this claim and ending up with a monitoring system which is acceptable to PPG, EPA and West Virginia. PPG will require the agreement of both EPA and DNR to any consent decree or stipulation which results from our efforts to settle this matter. The attached proposal consists primarily of the following:

- Installation of two additional topographically upgradient wells in an attempt to discover a discrete section with sufficient water yield for sampling. These two wells are expected to be dry and unsuitable for monitoring, but will at least provide assurance that no upgradient well is possible in the immediate vicinity of the pond.


May 2, 1984

- Installation of one "upgradient" well to the north of the pond which should contain groundwater in the same aquifer and lithology as the downgradient wells, but which does not actually pass under the impoundment. One of these three upgradient will be selected for monitoring if yield and conditions are satisfactory.
- Installation of one downgradient well, essentially midway between two of the existing three wells (GM-1 and GM-6). This well will be completely screened in the aquifer/water table.
- If perched water is discovered during the installation of the deep downgradient well, a neighboring, shallow well shall be installed and monitored for mercury and pH.
- All existing and active seeps will be monitored for mercury and pH.
- With respect to the wells, rather than monitor for pH, specific conductivity, TOX and TOC, PPG will monitor for mercury and pH. Specific conductivity, TOX and TOC result in false positives and should not be part of any monitoring program.

The above points are presented in more detail in the attachments. I am sending a copy of all of these documents to the West Virginia DNR and I propose that a meeting of PPG, EPA and DNR be held in Charleston or Philadelphia within the next two weeks to discuss this plan. Again, we do not want to make any commitment on well location and monitoring parameters until both agencies are in agreement. There is simply too much difference of opinion in this area for us to gamble that what is acceptable to EPA will be acceptable to DNR.

Please call me if you have any questions. I suggest a meeting the week of May 7 (with the exception of May 11). Please call me as soon as you have made a decision on your availability for such a meeting. I assume that you will coordinate with West Virginia.

Sincerely yours,


David C. Cannon, Jr.
Senior Attorney

DCC/eb

cc: Robert L. Jelacic, DNR
Douglas Donor, EPA

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INDEX

A. Documents requested by EPA

- A-1. Core Patterns for Brine Wells No.1 and No. 2.
- A-2. Organics and TOC analyses for mercury pond.
- A-3. Analyses of perched water zones - Wells GM-3, GM-5 and GM-7.
- A-4. Excerpted sections of plantwide Geraghty and Miller report.

B. Proposed Groundwater Monitoring Plan

A-1

Core Patterns for Brine Wells No. 1 and No. 2.

CORE RECORD

Company:

Well: BRINE WELL #1

Loc:

Elev:

Date:

CORE NO.	FROM	TO	RECOVERY	FORMATION	SHOWING	TYPE BARREL
3			HRS.	SPUD: 6-15-42		BIT No 1
1	0	12		Top of Ground to Top of Rotary		
689	12	25	6 1/2	Black Clay		
676	25	85		Sand & Gravel		
616	85	110	3	Hard Sand		
591	110	170		Brkn Hard sand		
531	170	215		" " " " Shale & Lime		
486	215	218		Black shale		
1	218	224		Coal		
1	224	230		Dark carbonaceous sandy shale		
	230	265		Sandy shale & Lim		
	265	350		" " " "		
BIT RECORD						
SET 319.16 of 13 3/8 @ 326.89 w/ 175 SX						
	350	374		Shale & Lime	BIT No 4	FROM 350 TO 405
	374	420		Shale & Sand	7	405 490 20 1/2
	420	545	8	" " "	8	490 1200 17
	545	628		Shale	9	1200 1325 14 3/4
	628	645	6	"	10	1325 1410 9.35
	645	778		Sandy shale & Lime, Brkn	11	1410
	778	800		Sandy shale		
	800	865	6 1/2	Broken Sand		
	865	912				

CORE RECORD

Company:

Well: BRINE No 1

Loc:

Elev:

Date:

CORE NO.	FROM	TO	RECOVERY	FORMATION	SHOWING	TYPE BARREL
	865	912		Sandy shale & Lime		
	912	1006	9 1/2	" " " "		
	1006	1077	7 1/2	Broken Sand & Shale		
	1077	1190	8	Sandy shale & Lime		
	1090	1208	1 1/4	Sand & Lime		
	1208	1221	8	Sandy Lime		
	1221	1286		Sandy Lime & Shale		
	1286	1298		" " " "		
	1298	1320	6 10	Hard Sand		
	1320	1332		Sandy shale & Lime		
	1332	1407	4	Lime & Hard Sand		
	1407	1425		Hard Sand		

OK M. Clam

Central File Copy



STATE OF WEST VIRGINIA
DEPARTMENT OF MINES
OIL AND GAS DIVISION

WELL RECORD

Permit No. MARS-135Oil or Gas Well Salt

(KIND)

Company Pittsburgh Plate Glass Company
Address New Martinsville, W. Va.
Farm Defense Plant Corporation Acres 225
Location (waters) E. bank of Ohio River near Proctor
Well No. 2 Elev. 710.0
District Franklin County Marshall
The surface of tract is owned in fee by Defense Plant Corp.
Address Washington, D.C.

Mineral rights are owned by _____

Address _____

Drilling commenced October 3, 1942Drilling completed December 21, 1942

Date Shot _____ From _____ To _____

With _____

Flow _____ /10ths Water in _____ Inch

_____ /10ths Merc. in _____ Inch

Time _____ Cu. Ft.

Rock Pressure _____ lbs. _____ hrs.

Oil _____ bbls., 1st 24 hrs.

Fresh water _____ feet _____ feet

Salt water _____ feet _____ feet

Casing and Tubing	Used in Drilling	Left in Well	Packers
Size			
16			Kind of Packer
18			
11-3/4		892	Size of
8-5/8		6,495	Depth set
6 1/2			
5 3/16			
4-1/2		6,859	Perf. top
2			Perf. bottom
Liners Used			Perf. top
			Perf. bottom

CASING CEMENTED Yes SIZE 8-5/8 No. Ft. 2,000 Date12-17-42COAL WAS ENCOUNTERED AT 242 FEET 0 INCHES

FEET INCHES FEET INCHES

FEET INCHES FEET INCHES

Formation	Color	Hard or Soft	Top	Bottom	Oil, Gas or Water	Depth Found	Remarks
Rotary Table			0	12.5			
Clay		Soft	12.5	28			
Sand & Gravel		"	28	80			
Shale & Shells		"	80	242			
Coal		"	242	247			
Shale		"	247	270			
Shale & Shells		"	270	370			
Shale		Hard	370	580			
Shale & Shells		"	580	640			
Red Bed &							
Sand		"	640	700			
Shale		"	700	809			
Sand &							
Sandy Shale		"	809	842			
Sand & Shell		"	842	880			
le		"	880	920			
dy Shale &							
Lime		"	920	946			
Sandy Shale &							
Sand		"	946	980			
Hard Sandy							
Shale & Lime		"	980	1055			
Sandy Lime		"	1055	1075			

Organics and TOC analyses and comparisons for mercury pond and downgradient wells.

- Purpose - To show that the impoundment is not the source of organic contamination in monitoring wells.
- Attached pages consist of the following:
 - Page 1 - Summary of TOC and TOX analyses performed in late 1983 and early 1984.
 - Page 2 - Table 2 of Geraghty and Miller report (December, 1983) which contains results of analyses done on October 19 and October 27, 1983, samples. (Note that TOC and TOX values in this table are contained in the Page 1 summary.)
 - Page 3 - Attachment III to state RCRA inspection report dated November 29, 1983, which shows August 3, 1983, analyses for downgradient wells GM-1 and GM-6. (Note that TOC and TOX values in this table are contained in the Page 1 summary.)
 - Pages 4, 5 - March 26, 1984, analyses (of March 23, 1984, samples) of organics in the mercury pond influent. (Note that these values are contained in the Page 1 summary.) As can be noted, the organics content was quite low for this sample. The Laboratory was asked to look for the particular organic component and when the component is reported as less than (), it is an indication that none could be found due to background level noise (below level of detection).
- Companion samples for the impoundment and the monitoring wells were not available in many instances.
- For TOC the samples for 8/3/83 were taken as parallel samples during the DNR inspection (under EPA contract). The data for the 10/19/83 and 10/27/83 samples were taken as part of the Phase I water quality assessment at the PPG mercury pond to explain the significant differences obtained under the RCRA water monitoring program.
- The Halo-Organic and Benzene analyses on the summary are from two sources. The 8/3/83 figures are the results reported by the EPA for the inspection mentioned earlier. The data for 3/23/84 were the results obtained by the Natrium Laboratory for comparison with monitoring well analysis.

SUMMARY

TOC

(Analysis in ppm)

	<u>8/3/83</u>	<u>10/19/83</u>	<u>10/27/83</u>
Hg Pond	--	4.0	3.9
GM-1	12	9.0	8.1
GM-2	--	5.7	3.1
GM-6	--	7.4	5.5

Halo-Org & Benzene

(analysis in ppb)

	<u>8-3-83 EPA</u>		<u>Natrium Mercury Pond</u>
	<u>GM-1</u>	<u>GM-6</u>	<u>3/23/84</u>
Methylene Chloride	10	11.1	4
Trans-1,2-Dichloroethane	ND	ND	<1
Chloroform	.916	1.60	6
Cis-1,2-Dichloroethane	25.4	53.4	<1
Carbon Tetrachloride	1.27	2.12	<1
Benzene	4.10	7.0	20
Trichloroethane	10.7	24.2	3.0
1,1,2-Trichloroethane	11.0	24.5	<1
Tetrachloroethane	28.9	26.0	3
Bromoform	3.40	5.91	<1
1,4-Dichlorobenzene	5.0	8.0	<10
1,2-Dichlorobenzene	10.1	15.7	<10
1,1-Dichloroethane	ND	ND	<1
1,1,1-Trichloroethane	.688	ND	<1
1,2-Dichloroethane	25.4	53.4	<1
Monochlorobenzene	ND	ND	<10
1,1,2,2-Tetrachloroethane	ND	ND	<10
1,3-Dichlorobenzene	ND	ND	<10
Hexachloroethane	ND	ND	<10
1,2,4-Trichlorobenzene	ND	ND	<10
1,2,3-Trichlorobenzene	ND	ND	<10
Unknowns			<10
Volatiles	ND	ND	
Aromatics	ND	ND	

ND = none detected

Analytical method on following laboratory report

TABLE 2.
RESULTS OF CHEMICAL ANALYSES CONDUCTED DURING THE PHASE I WATER-QUALITY ASSESSMENT
AT THE PPG MERCURY POND
(all values are expressed in mg/l unless otherwise specified)

Well Location	pH (std. units)	SC (umhos/cm)	TOC	TDS	Total ALK. (as CaCO ₃)	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	SiO ₂	Hg (ug/l)	Na/Cl
<u>10/19/83 Sample Set</u>																	
GM-0	6.9	678	1.2	425	212	259	19	84	-	-	-	-	-	-	-	-	-
GM-1	7.1	1158	9.0	650	602	734	18	<10	122	1.4	100	29	0.1	1.0	11.5	<0.5	6.8
GM-2	7.0	1355	5.7	758	596	727	79	<10	172	3.0	99	23	0.9	1.7	13.4	<0.5	2.2
GM-6	7.3	1050	7.4	635	207	253	61	188	97	2.7	98	16	<0.1	0.7	8.5	<0.5	1.6
Hg Pond	11.6	91625	4.0	85950	1424	1737	49000	1640	35200	19.4	13	<1	<0.1	<0.02	31.4	347	0.72
<u>10/27/83 Sample Set</u>																	
GM-0	7.1	719	1.4	485	202	246	27	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1178	8.1	675	599	731	49	<10	123	1.5	103	28	10.7	1.1	11.8	0.5	2.5
GM-2	7.0	1369	3.1	743	579	706	84	<10	203	3.2	92	21	5.1	1.5	13.8	<0.5	2.4
GM-6	7.2	1055	5.5	610	202	246	69	177	X	X	X	X	X	X	X	X	X
Hg Pond	12.0	61500	3.9	52400	5854	7142	29000	840	22000	17.4	16	1	0.1	<0.02	19.3	350	0.76
<u>Mean Average of 10/19/83 and 10/27/83 Data</u>																	
GM-0	7.0	699	1.3	455	207	253	23	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1168	8.6	663	601	733	34	<10	123	1.5	102	29	5.4	1.1	11.7	<0.5	3.6
GM-2	7.0	1362	4.4	751	588	717	82	<10	188	3.1	96	22	3.0	1.6	13.6	<0.5	2.3
GM-6	7.3	1053	6.5	623	205	250	65	183	97*	2.7*	98*	16*	<0.1*	0.7*	8.5*	<0.5*	1.6*
Hg Pond	11.8	76563	4.0	69175	3639	4440	39000	1240	28600	18.4	15	<1	<0.1	<0.02	25.4	349	0.73

- Not analyzed

X Insufficient sample volume for analyses

* Value based entirely on 10/19/83 data

ATTACHMENT III

Surface Impoundment
 ...um, West Virginia
 Samples collected on August 3, 1983

Chemical Analyses

(Analyses in mg/l unless otherwise stated)

Parameter	<u>Sampling Point</u>		
	GM-0	GM-1	GM-6
TOC	2	12	N.T.F.
Chloride	27	27	N.T.F.
Sulfate	121	1	N.T.F.
*Phenolics	1	4	N.T.F.
*Arsenic	<2	20	3
Lead	<.01	.03	.04
Barium	.06	1.2	.24
Cadmium	.001	.002	.003
*Mercury	<.1	.23	<.1

*Analyses in µg/l
 N.T.F. = Not Tested For

(Analyses in µg/l)

Parameter	<u>Sampling Point</u>			
	Field Blank	GM-0	GM-1	GM-6
Methylene Chloride	N.D.	1.78	10	11.1
1,2-Dichloroethene	N.D.	N.D.	25.4	53.4
1,1,1-Trichloroethane	N.D.	N.D.	.688	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	11.0	24.5
Bromoform	N.D.	N.D.	3.40	5.91
Tetrachloroethene	N.D.	51.0	28.9	26.0
Chloroform	N.D.	N.D.	.916	1.60
Carbon Tetrachloride	N.D.	N.D.	1.27	2.12
Trichloroethene	N.D.	7.91	10.7	24.2
Benzene	N.D.	N.D.	4.10	7.0
1,4 Dichlorobenzene	N.D.	N.D.	5.0	8.0
1,2-Dichlorobenzene	N.D.	N.D.	10.1	15.7
Volatiles	N.D.	N.D.	N.D.	N.D.
Aromatics	N.D.	N.D.	N.D.	N.D.

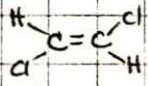
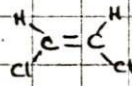

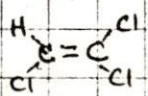
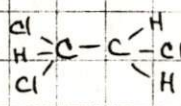
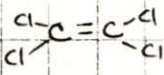


N.D. = None Detected

PPG INDUSTRIES, INC.
Chemical Division — Natrium
LABORATORY DEPT.

9C

C Rec'd.: 3-23-84 W.O. # 635520
Type Sample: Mercury Pond Influent H₂O Sample No.:
Submitted By: K. Walborn Dept.: Environmental
Report To: K. Walborn Date Reported: 3-26-84
Notebook No.: Lab file; book 1499 Page No.: 88

Analysis Required: Concn. of specific halo-organics + benzene

Component	Formula	Concn, ppb	Method
Methylene chloride	CH ₂ Cl ₂	4.	1
Trans-1,2-dichloroethene		< 1.	1
Chloroform	CHCl ₃	6.	1
Cis-1,2-dichloroethene		< 1.	1
Carbon tetrachloride	CCl ₄	< 1.	1
Benzene		20.	3
Trichloroethene		3.	1
1,1,2-Trichloroethane		< 1.	1
Tetrachloroethene		3.	1
Bromoform	CHBr ₃	< 1.	2
1,4-Dichlorobenzene		< 10.	3
1,2-Dichlorobenzene		< 10.	3

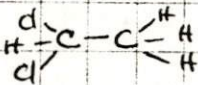
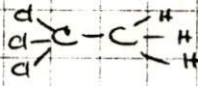
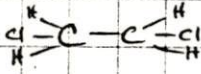

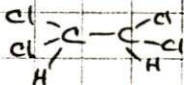

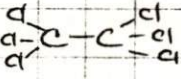


Methods:

- 1 Headspace/Tracor G/C - Packed column - Hall detector
- 2 Headspace/Shimadzu G/C - Packed column - EC detector
- 3 CS₂ extraction/Shimadzu GC - Capillary column - FID detector

PPG INDUSTRIES, INC.
Chemical Division — Natrium
LABORATORY DEPT.

Date Rec'd.: 3-23-84 W.O. # 635520
Sample: Mercury Pond Influent H₂O Sample No.:
Submitted By: K. Walborn Dept.: Environmental
Report To: K. Walborn Date Reported: 3-26-84
Notebook No.: Lab file; Book 1499 Page No.: 88

Analysis Required: Non-requested components/unknowns found/analyzed for during organics analysis.

Component	Formula	Concn, ppb	Method
1,1-dichloroethane		< 1.	1
1,1,1-trichloroethane		< 1.	1
1,2-dichloroethane		< 1.	1
Monochlorobenzene		< 10.	3
1,1,2,2-tetrachloroethane		< 10.	3
1,3-dichlorobenzene		< 10.	3
Hexachloroethane		< 10.	3
1,2,4-trichlorobenzene		< 10.	3
1,2,3-trichlorobenzene		< 10.	3
Unknowns (1)		< 10	3

Signed: J. Bogdan

(Page 2 of 2) A-2
Page 5

A-3

Perched zone water analyses (1981-1983).

- Attached for perched zone Wells GM-5 and GM-7 - no water was obtained at GM-3. Some of these analyses reflect testing for background levels under RCRA.

FFG INDUSTRIES
Chemical Division - Natrium
LABORATORY DEPT.

Well No GM-5

Date Rec'd.: See Back

Sample: Water

DEPT. ENV.

Submitted By: C. Drum

Report To: C. Drum

DATE

ANALYSIS REQUIRED	GUIDE LIMITS	11/13/80	Nov 1981	May 1982	Jun 1982	Nov 1982	Apr 83	Aug 83
pH	✓6.5-8.5	7.9	7.2 7.2 7.2 7.2	7.1 7.1 7.1 7.1	7.1 7.2 7.1 7.2	7.2 7.2 7.2 7.2	7.1 7.1 7.1 7.1	7.1 7.1 7.1 7.2
(Micro Mhoc) Specific Conductance 25°C			730 720 720 730	4x 700	715 737 750 767	765 744 733 731	794 797 794 796	4x 800
TOC mg/l		9.0	10.9 11.1 11.1 13.1	1.3 1.2 1.2 1.2	1.0 1.2 1.1 1.2	3.2 3.1 3.1 3.1	5.6 5.7 5.7 5.7	4.6 4.9 4.3 4.4
TOX µg/l Cl			4x <40	120 80 60 20	70 30 80 20	160 90 168 110	70 90 70 110	160 170 70 170
Cl mg/l	✓250 mg/l	39	72	30	35	41	35	29
Al mg/l	✓250 mg/l	81	63	58	60	52	67	55
Fe mg/l	✓.3 mg/l	<.1	16.3	.4	2.4	3.2	2.3	.2
Mn mg/l	✓.05 mg/l	.012	1.6	.4	1.8	1.2	1.6	.4
Na mg/l		51.9	46	36	130	48	49	40
anol mg/l			.02	.02	.006	.003	.02	.007
AsT mg/l	*.05 mg/l + 5 mg/l	.005	.01	.005	.007	.005		.005
BaT mg/l	*1 mg/l + 100 mg/l	.10	.45	.13	.43	.27		.14
CdT mg/l	*.01 mg/l + 1 mg/l	.005	.01	.004	.089	.01		.001
CrT mg/l	*.05 mg/l + 5 mg/l	<.01	.01	.012	.021	.01		
PbT mg/l	*.05 mg/l + 5 mg/l	.005	.09	.006	.083	.020		.005
Li mg/l	*.002 mg/l + .2 mg/l	.0005	.001	.0006	.0001	.0005	.0002	.0002
SeT mg/l	*.010 mg/l + 1 mg/l	.005	.005	.005	.005	.005		
AgT mg/l	*.05 mg/l + 5 mg/l	.005	.010	.004	.011	.010		
Nitrate (N) mg/l	.10 mg/l		.48	.5	.42	.24		
F mg/l	*2.4 mg/l	.6	.6	1	1	1		
Endrin mg/l	*.0002 mg/l + .02 mg/l		.0002	.0002	.0002	.0002		
Lindane mg/l	*.004 mg/l + .4 mg/l		.0001	.004	.004	.004		
Methoxychlor mg/l	*.1 mg/l + 10 mg/l		.003	.005	.1	.1		
Toxaphene mg/l	*.005 mg/l + .5 mg/l		.003	.005	.005	.005		
2,4,D mg/l	*.1 mg/l + 10 mg/l		.01	.01	.1	.1		
5,TP Silvex mg/l	*.01 mg/l + 1 mg/l		.01	.01	.01	.01		

Based on Primary Drinking Water Standards.

Retranscribed K Walborn 4/5/84

Chemical Division—NATRIUM
LABORATORY DEPT.

Well No GM-5

Rec'd.: See Back

Type Sample: Water

DEPT. ENV.

Submitted By: C. Drum

Report To: C. Drum

DATE

ANALYSIS REQUIRED		GUIDE LIMITS	11/13/80	Nov 1981	MAY 1982	JUN 1982	Nov 1982	Apr 83	Aug 83
Radium 226	pCi/l	5. pCi/l		.9	1.3	.6	}		
Radium 228	pCi/l			1	1	1			
Gross Alpha	pCi/l	*2. pCi/l		<2	<2	<2	<2		
Gross Beta	pCi/l	* dose4m-rem./yr.		<3	<3	7	<5		
Turbidity	J.T.U.	*1 to 5		1500	220	140	292		
Coliform Bact. Colonies/100		*M.F. 4 colonies/100		700	<20	<5	<1		
Alkalinity (as CaCO ₃)	mg/l		235	564	313	296	297	313	326
Alkalinity as HCO ₃	mg/l		287		382	361	356	382	398
Color	APHA	✓15	5	25	0	5	5	0	0
TDS	mg/l	✓500 mg/l	338	432	478	435	438	445	438
Ca	mg/l		84.7	114	100	154	104	141	97
	mg/l	✓1 mg/l	<.1	.11	.008	.022	.03	.03	.01
K	mg/l		2.6	7.1	1.7	3.2	2.0	2.3	1.9
Zn	mg/l	✓5 mg/l	<.1	<1	<.02	.12	.2	.1	.1
Mg	mg/l		10.6	27.8	20.7	30.1	22.7	26.7	22.5
V	mg/l			.075	.010	.020	.010	.02	.01

Based on Primary drinking water Standards.

Date analyzed 11/13/80

FFG INDUSTRIES
Chemical Division - Natrium
LABORATORY DEPT.

Well No GM-7

Site Rec'd.: See Back

Sample: Water

DEPT. ENV

Submitted By: C. Drum

Report To: C. Drum

DATE

ANALYSIS REQUIRED	GUIDE LIMITS	9/1/81	Nov 1981	MAR 1982	June 1982	Nov 1982	APR 1983	Aug 1983
pH	✓6.5-8.5	7.44	7.4X	6.8 4X	6.9 4X	6.9 4X	6.8 4X	6.9 7.0
(Micro Mhoc)		1010 1040	790 790	900 4X	867 940	820 846	932 934	1350
Specific Conductance 25°C		1030 1020	770 800	803 802	855 861	934 934	1350 4X	
TOC mg/l		14.7 22.9	9.6 12.1	1.4 1.3	13.2 12	2.2 2.1	17.7 125	6.5 6.1
		19.7 163	6.9 6.7	1.3 1.3	12.3 12	2.2 2.4	17.8 143	6.2 6.2
TOX µg/l Cl		39	20 4X	20 4X	20 4X	20 4X	50 4X	70 80
Cl mg/l	✓250 mg/l	75	56	39	35	39	48	69
SO ₄ mg/l	✓250 mg/l	44	36	20	26	48	37	< 10
Fe mg/l	✓.3 mg/l	8.7	15.7	1.6	.9	1.6	.3	5.9
Mn mg/l	✓.05 mg/l	1.0	1.2	7.7	2.9	.7	1.2	2.9
Na mg/l		143	64	41	130	50	41	176
Pl µl mg/l		0.018	.01	.008	.005	.001	.013	.001
AsT mg/l	*.05 mg/l + 5 mg/l	.005	.009	<	<	<		.031
BaT mg/l	*1 mg/l + 100 mg/l	.19	.29	.17	.16	.25		.33
CdT mg/l	*.01 mg/l + 1 mg/l	.019	.01	.003	.006	.01		.001
CrT mg/l	*.05 mg/l + 5 mg/l	.018	.01	.014	.009	.01		
Pb mg/l	*.05 mg/l + 5 mg/l	.009	.02	.007	.005	.013		.017
HgT mg/l	*.002 mg/l + .2 mg/l	.0005	.0001	.0002	.0001	.0005	.0002	.0002
SeT mg/l	*.010 mg/l + 1 mg/l	.005	.005	.005	.005	.005		
AgT mg/l	*.05 mg/l + 5 mg/l	.010	.01	.004	.005	.01		
Nitrate (N) mg/l	.10 mg/l	.3	.1	1.0	.1	.2		
F mg/l	*2.4 mg/l	.3	.3	1	1	1		
Endrin mg/l	*.0002 mg/l + .02 mg/l	.0003	.0002	.0002	.0002	.0002		
Lindane mg/l	*.004 mg/l + .4 mg/l	.0001	.0001	.004	.004	.004		
Methoxychlor mg/l	*.1 mg/l + 10 mg/l	.002	.003	.005	.001	.001		
Toxaphene mg/l	*.005 mg/l + .5 mg/l	.0001	.003	.005	.005	.005		
2,4-D mg/l	*.1 mg/l + 10 mg/l	.004	.01	.01	.10	.10		
2,4,5-T Silvex mg/l	*.01 mg/l + 1 mg/l	.004	.01	.01	.01	.01		

Based on Primary Drinking Water Standards. Transcribed K. Walborn 4/5/84

Chemical Division - NATION
LABORATORY DEPT.

Well No GM-7

te Rec'd.: See Back

Sample: Water

DEPT. ENV

Submitted By: C. Drum

Port To: C. Drum

DATE

ANALYSIS REQUIRED	GUIDE LIMITS	9/1/81	Nov 1981	MAR 1982	June 1982	Nov 1982	APR 1983	AUG 1983
Radium 226 pCi/l	5. pCi/l	<.6	1.4	.6	.6	7		
Radium 228 pCi/l		<1	<1	<1	<1	<1		
Gross Alpha pCi/l	*2. pCi/l	<2	<2	<2	<2	<4		
Gross Beta pCi/l	* dose 4m-rem./yr.	<3	8±5	<3	<3	<5		
Turbidity J.T.U.	*1. to 5	41	230	320	<100	260		
Coliform Bact. Colonies/100	*M.F. 4 colonies/100	640	2000	<20	<5	<5		
Alkalinity (as CaCO ₃) mg/l		391	626	422	391	422	415	625
Alkalinity as HCO ₃ mg/l		477		515	477	515	506	763
Color APHA	√15	5	5	0	0	30	0	0
SDS mg/l	√500 mg/l	573	464	517	481	521	517	750
Ca mg/l		92	152	124	110	119	136	99
Fe mg/l	√1 mg/l	.033	.032	.026	.010	.03	.03	.02
Mn mg/l		6.4	4.9	1.6	.1	2.0	1.8	3.8
Pb mg/l	√5 mg/l	.11	<1	.016	.065	.2	<.1	<.1
Zn mg/l		15	30	25	23	23	26	24
Cu mg/l			<.01	.013	.006	.01	.01	.01

Based on Primary Drinking Water Standards. Transcribed K. Walkorn 4/5/84

A-4

Hydrogeologic Conditions at the PPG Industries, Inc., Plant Site,
Natrium, West Virginia:

- Excerpt from Geraghty and Miller, Inc., Final Report, October 1982, containing pages 11-18, 22, 23, 25, 27-37, 38-45.
- None of the attached material is considered confidential by PPG.

copy 4 of 5

Geraghty & Miller, Inc.

HYDROGEOLOGIC CONDITIONS AT THE
PPG INDUSTRIES, INC., PLANT SITE
NATRIUM, WEST VIRGINIA

FINAL REPORT

Prepared for
PPG Industries, Inc.
Natrium, West Virginia

October 1982

By
Geraghty & Miller, Inc.
Annapolis, Maryland

REGIONAL SETTING

Topography

Natrium is situated within the Ohio River Valley near the base of the West Virginia Northern Panhandle. This area is part of the Appalachian Plateau physiographic province and, in general, can be described as a highly dissected plateau or plain characterized by rugged topography, steep slopes, and strong relief, with elevations ranging from about 600 feet to more than 1600 feet above sea level. Stream erosion and transport, in conjunction with weathering and mass-wasting of slope materials, is largely responsible for the existing topographic expression of this region.

The Ohio River generally constitutes the feature of lowest elevation throughout the area and, thus, receives virtually all of the natural drainage via tributaries, surface runoff, overland flow, and groundwater discharge. Surface drainage patterns in the region can best be described as dendritic, where larger tributaries branch irregularly and angularly into smaller tributaries, resembling, in plan, the profile of a branching tree.

A notable exception to the rugged topography described above occurs in areas adjacent to the Ohio River and some

of its major tributaries where the deposition of flood plains and the carving of terraces into older and higher glaciofluvial outwash has created relatively level or gently inclined strips of land that tend to parallel the course of the river. These land features, which are commonly referred to as bottoms or bottomlands, are usually best developed on the inside of meanders (bends in a river) and fringe the Ohio River on alternate sides throughout its length. Owing to the flat-laying topography, the availability of water, and the close proximity to a major waterway, bottomlands along the Ohio have long been major centers of population and industry in the State.

Climate

Climate of the area is typical of temperate continental zones with warm summers and cold winters averaging 73°F and 34°F, respectively. The mean annual temperature for this area is about 53°F (Price, and others, 1956).

Precipitation is ample and fairly well distributed throughout the year with maximum and minimum rainfall occurring in summer and fall, respectively. Total annual precipitation in the Ohio Valley increases from north

to south. Normal precipitation for Wheeling is approximately 38 inches and for New Martinsville is about 44 inches. There are no available precipitation data for Natrium; it is assumed that average precipitation at the plant site ranges from 42 to 44 inches per year.

Geology

The Northern Panhandle region is underlain by Paleozoic-age sedimentary rocks consisting mainly of conglomerates, sandstones, siltstones, shales, fresh-water and marine limestones, and coals, and lesser amounts of chert, iron ore, and rock salt or other evaporites. Coal deposits, which mainly occur in Pennsylvanian-age and, to a lesser extent, Permian-age rocks, have long been recognized as the greatest mineral resource of the Ohio River Valley area. Rock salt and natural brines of Silurian-age are of local importance to PPG and other chemical industries for the manufacture of chlorine, bleaches, soda ash, and caustic soda.

In hilly, more elevated areas of the Panhandle, rock units are generally overlain by a thin to moderately thick layer of sedentary or residual soil that has been formed in place by the distintegration of underlaying rocks, and

by the accumulation of organic material. These soils are usually relatively fertile and well drained and are capable of supporting woodland, cropland, and pasture. Owing to the hilly topography characterizing these areas, soils tend to be fairly susceptible to erosion.

In areas adjacent to the Ohio River, steep valley walls with outcropping rocks of Pennsylvanian- and Permian-age give way rather abruptly to bottomland alluvial deposits comprising flood-plain and river-terrace features. River terraces generally represent Pleistocene-age glacial outwash plains that have been carved into a stepped profile by the downcutting Ohio River. These features are mainly composed of sand and gravel and, in areas along the edges of the valley, may be capped by colluvium (clay and rock fragments) derived from highlands and valley walls. Lower river terraces may, in some cases, also represent abandoned flood plains constructed by the river during past, more elevated regimens. Such deposits probably contain significantly greater quantities of silt and clay than are found in terraces formed primarily from glacial outwash.

In the Natrium area, three main terrace levels are present with lower, middle, and upper terrace elevations

averaging 630, 660, and 690 feet above mean sea level, respectively. The upper terrace is bounded on the east by a steep valley wall that rises to an elevation of 1300 feet within one mile. The lower extent of the upper terrace is roughly delineated by West Virginia State Route 2, and the lower boundary of the middle terrace is similarly defined by the Baltimore and Ohio railroad. The lower-most terrace face is bounded by the Ohio River. These terraces, with the possible exception of the lower terrace, lie above the highest expected flood stage of the Ohio River; the Ohio River pool elevation in the Natrium area is about 620 to 624 feet above mean sea level and, as a result of downstream locks and dams, tends to remain fairly constant throughout high- and low-flow periods.

The higher river terraces are generally underlain by 90 to 110 feet of alluvium which lies unconformably upon bedrock of Paleozoic-age. The bedrock materials slope from the valley wall toward the Ohio River, probably reflecting the configuration of the river valley prior to aggradation by glacial outwash.

Water Resources

The Ohio River represents the main body of surface water in the area and, with respect to volume, constitutes an almost unlimited supply. The quality of water from the Ohio River is suitable for many industrial uses; however, owing to the possible presence of undesirable chemical constituents resulting from upstream operations, river water would probably require some type of treatment before it would be acceptable for most domestic purposes. Table 1 summarizes the water quality of the Ohio River at Newell (north of Natrium) and Ravenswood (south of Natrium), West Virginia, and of Fishing Creek at New Martinsville (south of Natrium).

Groundwater constitutes a major source of water supply in the Natrium area. The most important water-bearing unit, the water-table aquifer, is comprised of the sand and gravel alluvial materials of the Ohio River valley. Yields from wells penetrating these sediments are reported to range from 100 to 500 gallons per minute (gpm), and natural water quality is generally good with total dissolved solids concentrations of 500 mg/l or less; locally, water may be hard and sulfurous (Price, and others, 1956). PPG is

Table 1. Quality of Surface Water in the Ohio River Valley Near Natrium, West Virginia (Doll, W. L., Meyer, G., and Archer, R. J., 1963)
(All analyses are expressed in mg/l, except pH and specific conductance, which are expressed in standard units).

PARAMETER	Ohio River at Newell, W. Va. (1960 mean)	Ohio River at Ravenswood, W. Va. (1960 mean)	Fishing Creek New Martinsville, W. Va. (10/1/60)
Specific Conductance	360	413	304
Total Dissolved Solids	226	255	164
pH	-	-	7.4
Calcium	32	39	26
Sodium	19	24	21
Magnesium	9.2	9.6	6.1
Potassium	2.2	2.3	2.2
Total Iron	-	-	0.3
Manganese	-	-	0.28
Chloride	15	31	40
Bicarbonate	14	36	75
Sulfate	122	111	23
Nitrate	3.9	3.9	0.2
Fluoride	0.3	0.3	0.2
Silica	7.4	6.9	3.1
Total Hardness as CaCO ₃	225	245	118

presently pumping about five million gpd from wells constructed into this aquifer.

The Paleozoic bedrock units, which underlay the sand and gravel aquifer, are also capable of producing groundwater. Because well yields are generally low and water quality is often poor, these units have not been extensively developed as a groundwater supply in the Natrium area.

Table 2. Results of Grain-Size Distribution and Falling-Head Permeability (Kv) Analyses

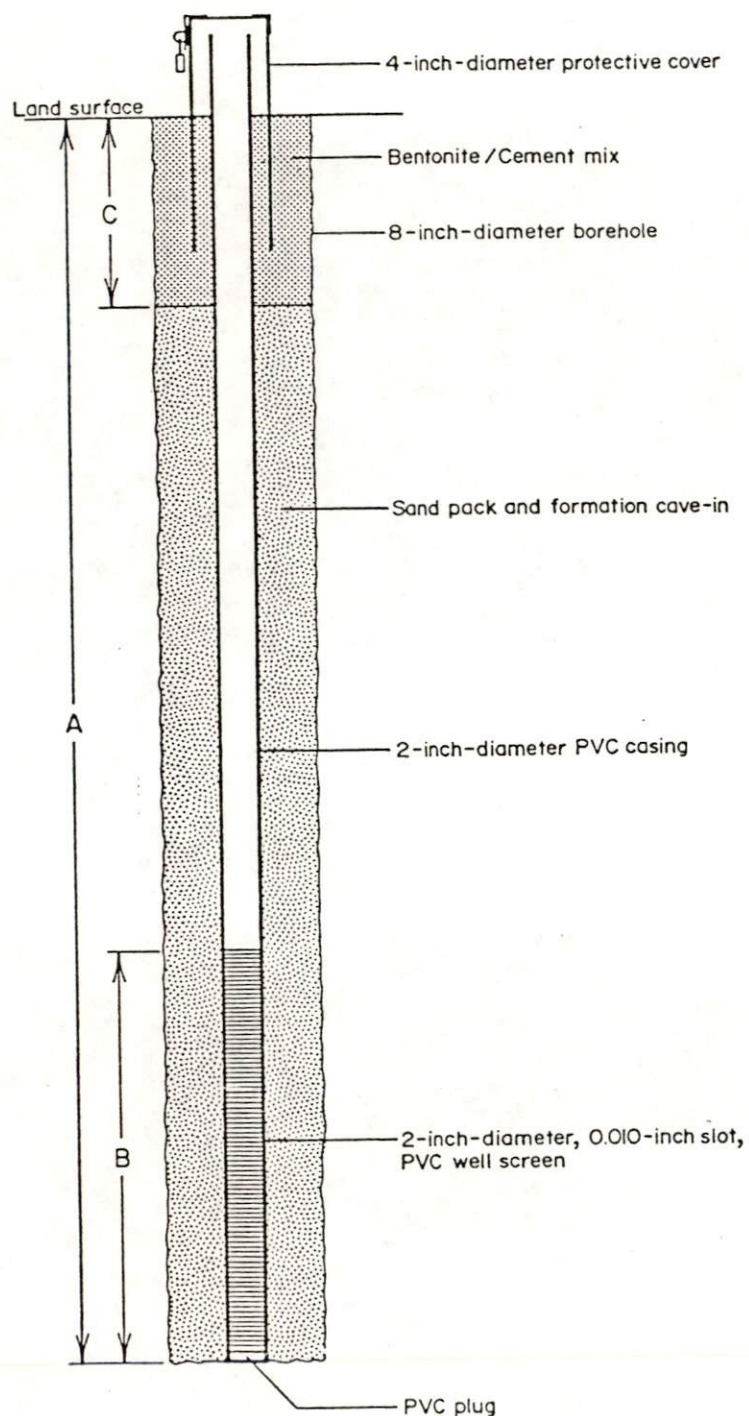
Well Number	Sampling Depth (ft)	Permeability (cm/sec)	Natural Moisture Content (%)	Gravel 2-76mm (%)	Sand 0.074-2mm (%)	Fines <0.074mm (%)	Type of Material
MW-5	30.0 - 31.5	NA	26.5	1	60	38	Silty clayey sand
MW-7	60.0 - 61.5	NA	16.7	4	94	2	Sand with trace of gravel
MW-12	75.0 - 76.5	NA	8.4	49	40	11	Silty sand and gravel
*MW-15	11.5 - 13.5	3.4×10^{-7}	20.0	17	20	63	Sandy silty clay
*MW-16	22.5 - 24.5	2.2×10^{-6}	20.6	14	12	74	Sandy clayey silt

*Shelby tube sample

NA - Not Analyzed

Table 3. Results of Cation-Exchange Analyses

Well Number	Sampling Depth (ft)	Type of Material	Cation Exchange Capacity (meq/100g)
MW-9	10.0 - 11.5	Clay with pebbles	5
MW-9	60.0 - 61.5	Sand with a few pebbles	4
MW-15	20.0 - 21.5	Silty clay	4
MW-15	50.0 - 51.5	Sand with pebbles	6
MW-18	15.0 - 16.5	Silty clay	7
MW-18	40.0 - 41.5	Sand with pebbles	3



MONITOR WELL NUMBER	DIMENSIONS, IN FEET		
	A	B	C
MW-1	52.5	10.0	15.0
MW-2	97.0	30.0	21.0
MW-3	50.0	30.0	6.0
MW-4	56.0	40.0	5.0
MW-5	40.5	32.0	6.0
MW-6	74.0	40.0	8.0
MW-7	83.0	40.0	17.0
MW-8	83.0	40.0	3.5
MW-9	82.5	40.0	20.0
MW-10	90.0	30.0	20.0
MW-11	90.0	30.0	17.0
MW-12	88.0	30.0	3.0
MW-13	84.0	30.0	20.0
MW-14	67.5	37.0	18.0
MW-15	69.5	40.0	10.0
MW-16	64.0	43.0	10.0
MW-17	66.0	40.0	14.0
MW-18	64.5	40.0	10.0
MW-19	89.0	40.0	12.0

Figure 4. Typical Monitor-Well Construction, PPG, Natrium, West Virginia

Aquifer-Testing Program

On September 28 and 29, 1981, an aquifer-testing program consisting of recovery and drawdown monitoring was conducted in the northwest corner of the main plant site. This program, which was aimed at better defining the hydraulic properties of aquifer materials, utilized process well 28 as a controlled pumping center and observation wells 28-AM, 28-BM, MW-7, and MW-8 as potentiometers for monitoring changes in water-level elevation (see Figure 5 for approximate well locations).

For at least three days prior to the test, well 28 was continuously pumped at a rate ranging from 365 to 425 gpm. After taking preliminary water-level measurements in the four observation wells to verify that groundwater levels were not fluctuating, pumping of well 28 was discontinued. The level of water in wells began to rise and the rate of this recovery was measured periodically in the four observation wells for the next 21 hours. Due to time allotments for the test, it was not possible to allow water levels to reach a non-fluctuating condition; however, when the recovery test was stopped, water levels were rising at a very slow rate. Pumping of well 28 was then resumed at an average rate of 390 gpm, and water-level drawdown was

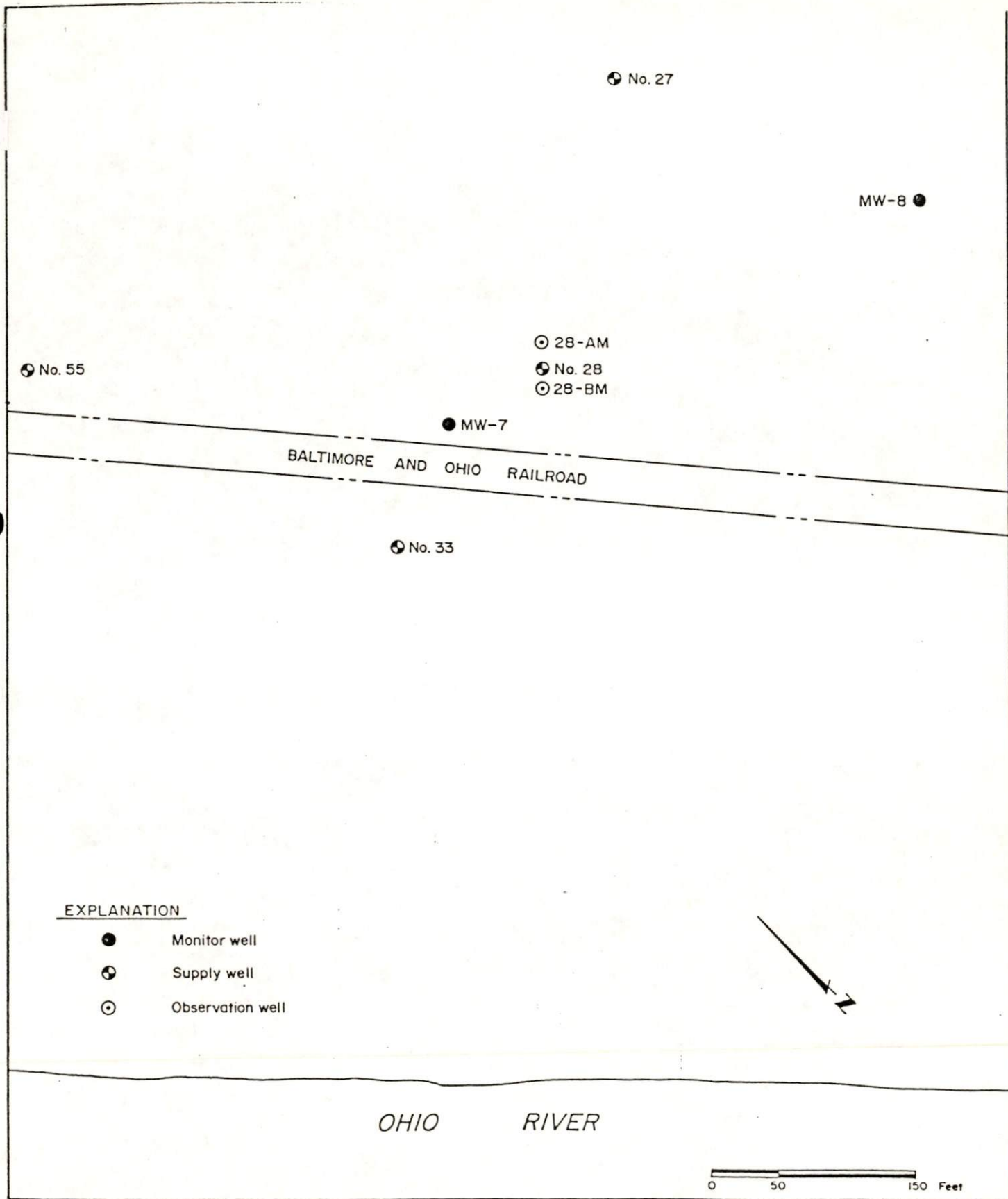


Figure 5. Well Locations in the Aquifer-Testing Area at PPG, Natrium, West Virginia

measured in the observation wells over the next seven hours. At the end of seven hours, the water level in the 28-BM observation well was still dropping slightly, but levels in the other three observation wells appeared to be relatively stable.

It should be noted that prior to and throughout the aquifer-testing program, PPG supply wells 27, 33, and 55 were in continuous operation; these wells are situated in relatively close proximity to well 28 (see Figure 5) and may have affected water levels in the observation wells. This situation may have caused some anomalies in drawdown and recovery data, particularly if the pumping rates of nearby wells fluctuated significantly during the testing period.

Recovery and drawdown data for observation wells 28-AM and 28-BM were graphically plotted as time versus recovery and time versus drawdown relationships, and the Jacobs method was used to calculate values of transmissivity (T) and storage coefficient (S) (Johnson Division, 1975). Data from observation wells MW-7 and MW-8 were not extensively evaluated due to a lack of sufficient water-level response during pumping and recovery. Recovery

and drawdown data for the four observation wells are presented in Appendix F.

The calculated transmissivity (T) of the aquifer, based on recovery and drawdown data from the 28-BM well, was fairly consistent at 80,400 gpd/ft and 93,600 gpd/ft, respectively (see Figure 6); assuming a saturated aquifer thickness (m) of about 40 feet, these values correspond to a hydraulic conductivity (K) of roughly 2175 gpd/ft² (10⁻¹ cm/sec). The storage coefficient (S) determined from calculated T values is unrealistically high, 0.98 and 1.23, respectively; typical S values for water-table aquifers range from 0.01 to 0.35. The high calculated S value probably reflects aquifer recharge by the Ohio River.

Aquifer transmissivity (T) as determined from recovery and drawdown data in the 28-AM well varied substantially at 111,735 gpd/ft and 27,934 gpd/ft, respectively. Owing to the difference in calculated T value and uncertainties as to what factors may have caused this variation, data obtained from the 28-AM well are not considered valid will not be discussed further.

It should be noted that in April 1962, Rawe Drilling Company also conducted an aquifer test using well 28 and

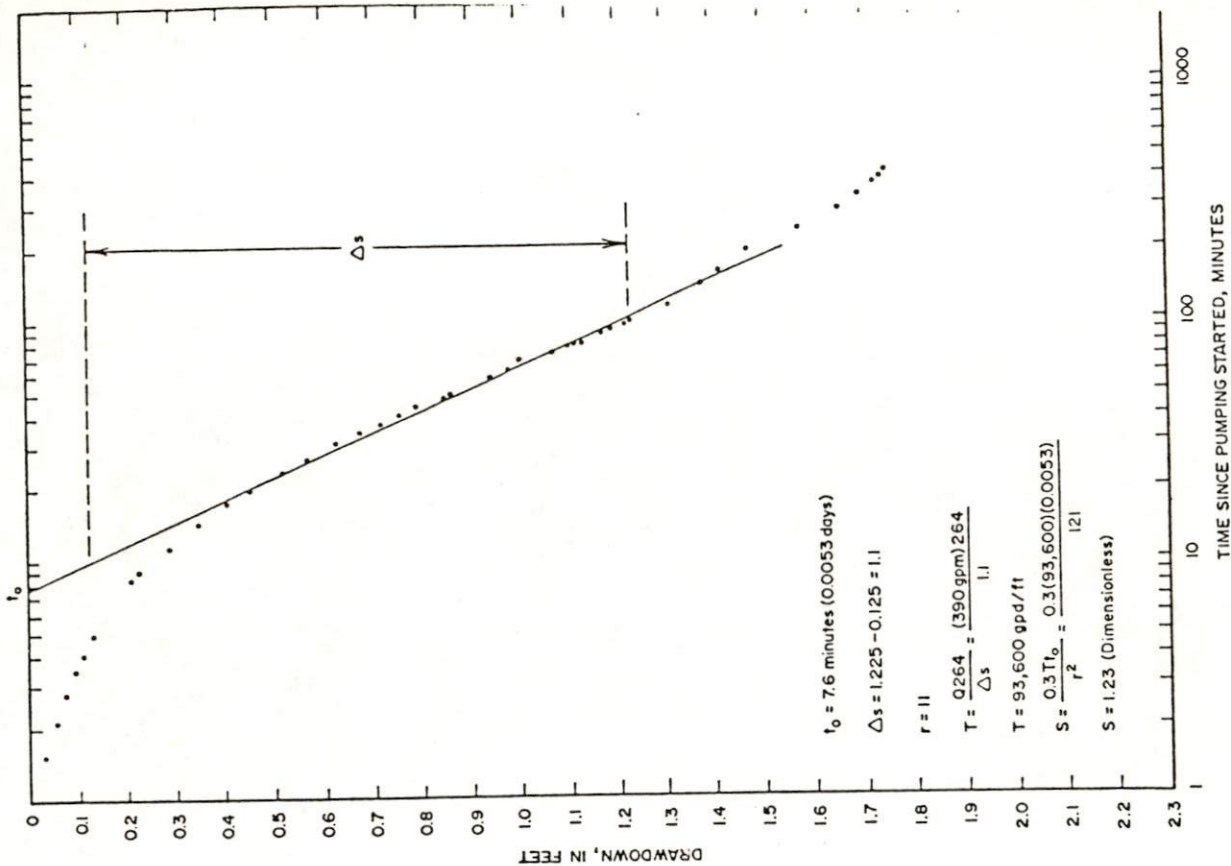
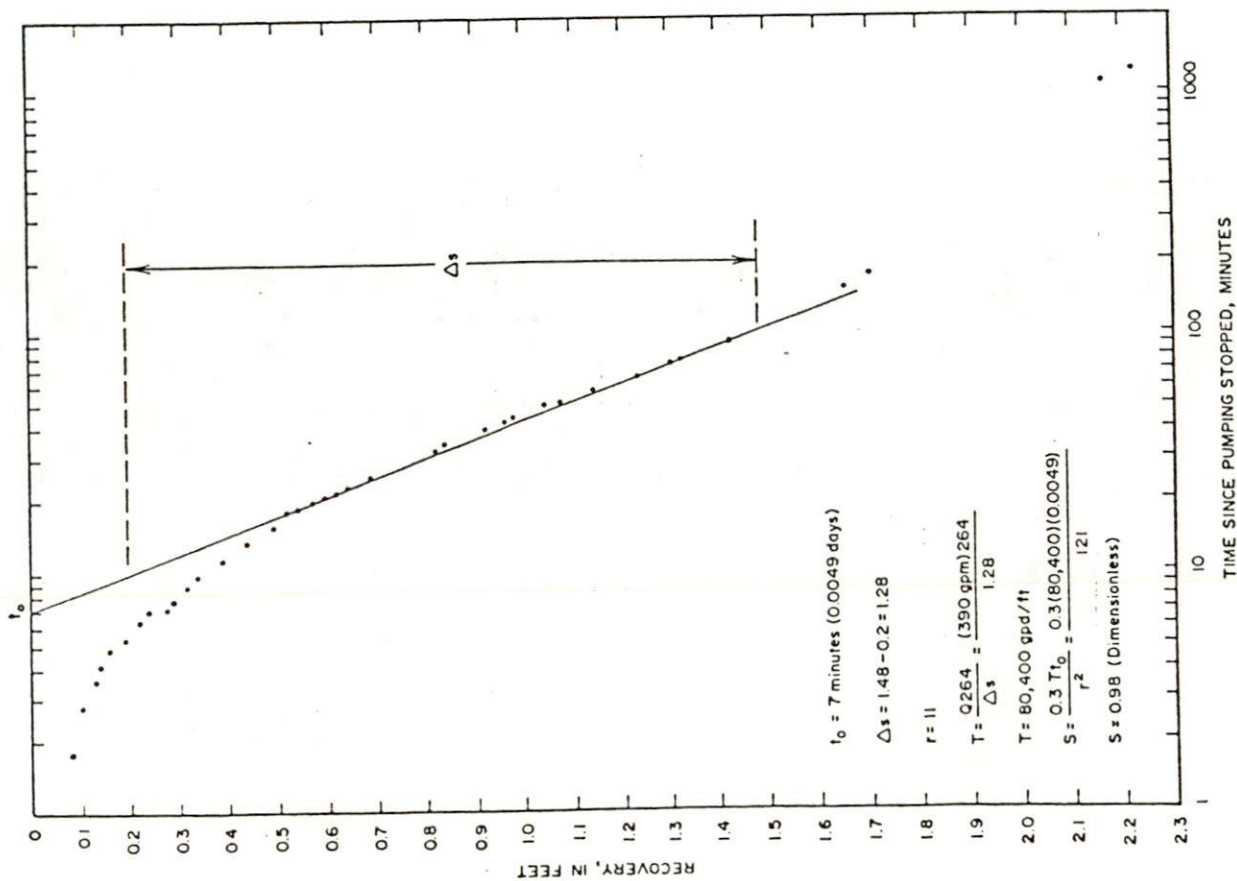


Figure 6. Graphical Representation of Recovery and Drawdown Data, 28-BM Location, PPG, Natrium, West Virginia

observation wells 28-AM and 28-BM. The reported transmissivity from this test was 539,000 gpd/ft. Inconsistencies in the reported data, and the fact that T values of this magnitude are not typical for the type of materials comprising this aquifer, make the results reported by Rawe somewhat suspect.

SITE HYDROGEOLOGIC CONDITIONS

Geology

The plant site is underlain by unconsolidated deposits of sand, silty to sandy clay, and pebbles, which lie unconformably upon a bedrock base. Results of grain size analyses presented in Table 2 indicate the gross physical composition of soil samples selected to represent unconsolidated deposits.

Throughout central portions of the plant, roughly parallel to Skyline Drive, sediments consist predominantly of sand and pebbles which extend downward 90 feet or more to bedrock. In the east and west (upper and lower) plant areas, sand is generally overlain by beds of silty to sandy clay which tend to thicken toward the Ohio River and the valley wall (see Figures 7 through 10).

The coarser soil materials (i.e., sand and gravel) are composed primarily of quartz and lesser amounts of feldspar minerals, as determined by visual inspection. No laboratory tests were conducted to determine the exact mineralogy of clays and finer soil fractions; however, the low cation exchange capacities (7 meq/100 g or less) determined for clay-rich samples suggest that kaolinite $[Al_4(Si_4O_{10})(OH)_8]$

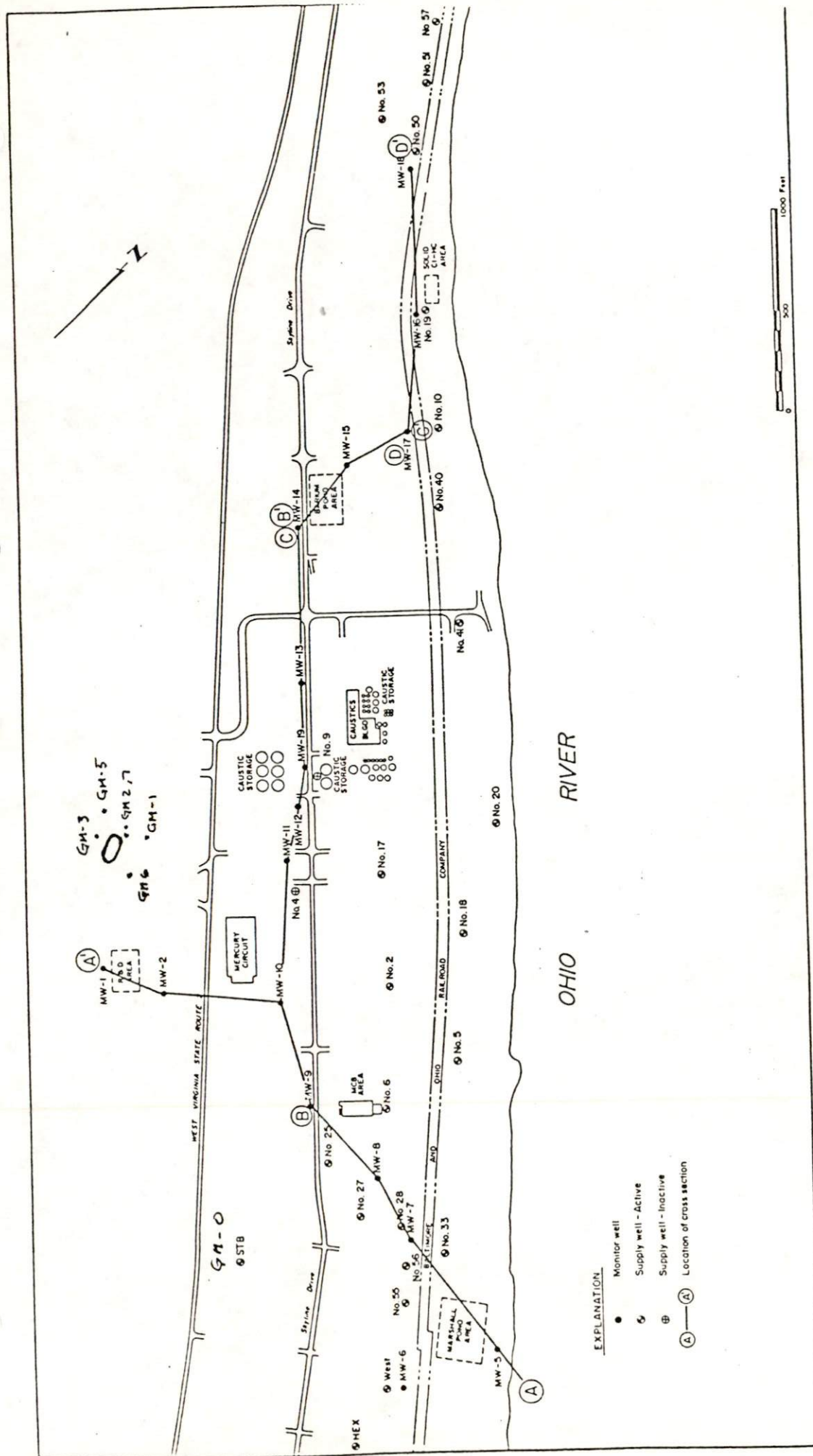


Figure 7. Geologic Cross-Section Reference Map, PPG, Natrium, West Virginia

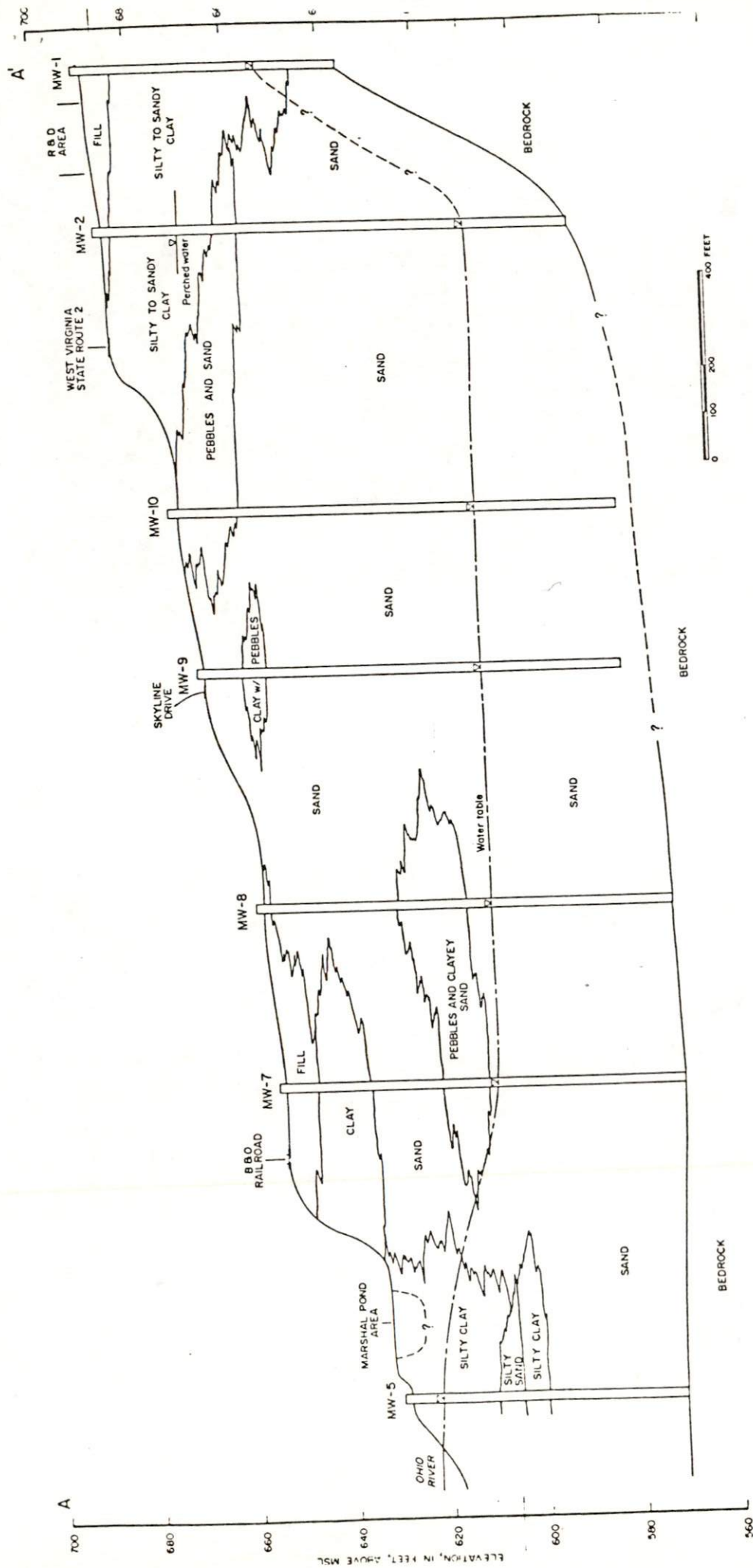


Figure 8. Geologic Cross-Section A-A', PPG, Natrium, West Virginia

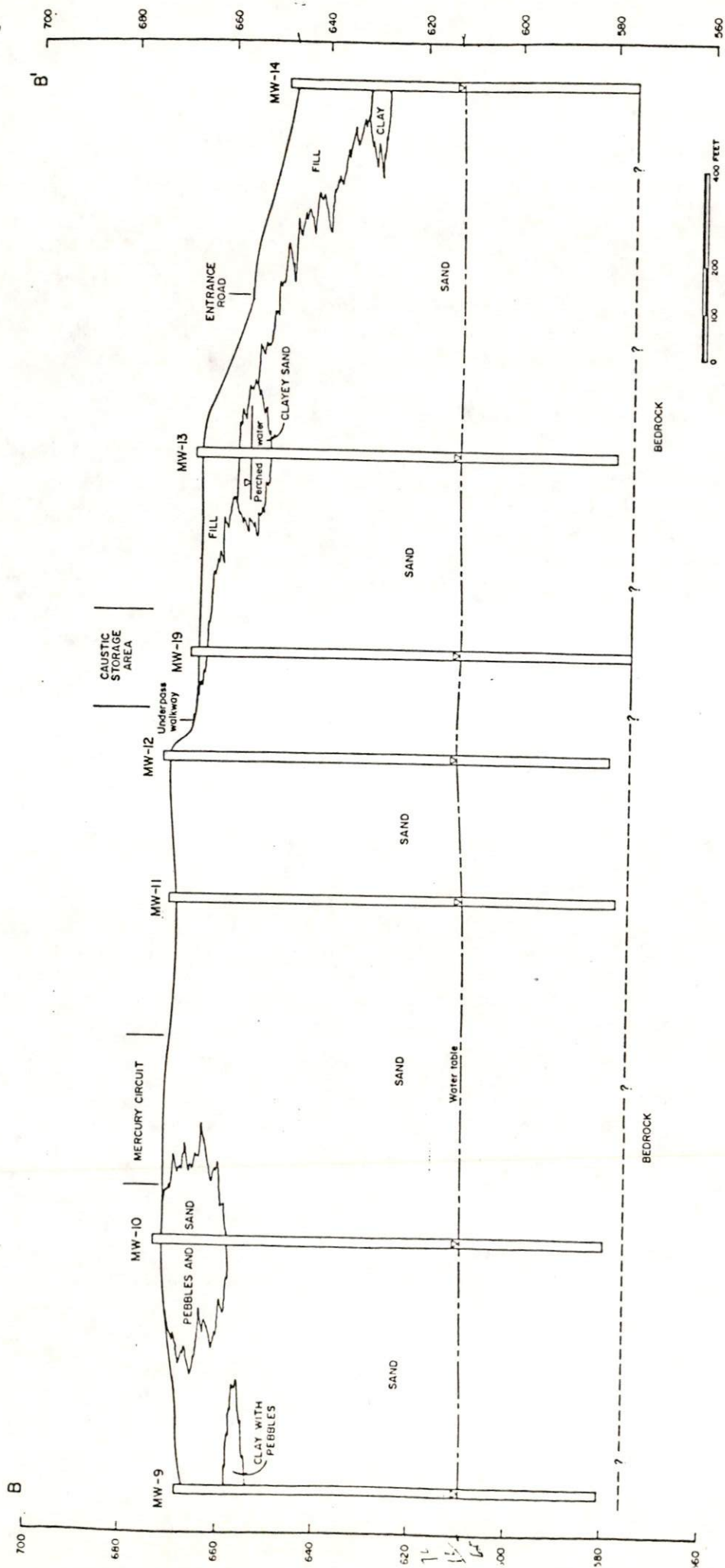


Figure 9. Geologic Cross-Section B-B', PPG, Natrium, West Virginia

may be a primary component (Garrels and Christ, 1965). Results of cation exchange analyses are presented in Table 3.

As noted in the preceding section, most of the sand and gravel materials comprising Wells Bottom are thought to represent outwash that aggraded the Ohio River Valley during retreat of Pleistocene glaciers. Accumulations of finer sediments, particularly in areas adjacent to the Ohio River, may also represent deposition of floodplain alluvium during more elevated river regimens. Silty to sandy clay deposits underlaying upper plant areas probably, for the most part, represent locally deposited colluvium and detrital materials derived from weathering and mass-wasting of uplands and valley walls; rock fragments are common throughout these sediments.

Aquifer Characteristics and Groundwater Flow

Two types of water-bearing zones are present at the plant site: 1) discontinuous zones of perched groundwater, and 2) the Ohio River Valley water-table aquifer. Perched zones represent unconfined groundwater that is separated from the water table by an unsaturated zone. When present, perched zones were generally situated within silty to sandy

clay materials which, due to their relatively low permeability (Table 2), restrict the downward percolation of recharge waters. The locations and depths of observed perched-water zones are indicated in Table 4 and on Figures 8 through 10.

The Ohio River Valley water-table aquifer is comprised primarily of sand and gravel, and constitutes the main water-bearing unit in the area. The aquifer has been extensively developed within the plant site and is presently yielding about five million gallons of water daily, most of which is being pumped from two main PPG well fields located in the northwest and southwest corners of the main plant (Figure 2).

Data obtained from the aquifer-testing program indicate that aquifer sediments typical of the central plant area are characterized by a transmissivity (T) probably ranging from 80,000 to 95,000 gpd/ft (see Figure 6). Based on an average saturated aquifer thickness of about 40 feet, this T corresponds to a hydraulic conductivity of about 10^{-1} cm/sec or greater.

No aquifer tests were conducted in areas of the plant along the Ohio River. However, in borings immediately

Table 4. Perched-Groundwater Zones Encountered During Drilling

Boring Number	*Depth to Perched Zone (ft below land surface)	*Elevation of Perched Zone (ft above MSL)	*Height of Perched Zone Above Water Table (ft)	Description of Sediments Containing the Perched Zone
MW-2	15.5	670	60	Silty to sandy clay with pebbles
MW-13	10.0	656	44	Clayey sand
MW-15	11.5	633	21	Silty to sandy clay
MW-18	5.0	635	22	Silty clay

*All depths and elevations are approximate

adjacent to the river (e.g., MW-4 and MW-5), the sand deposits appeared to be slightly more fine grained and more silty than in central plant areas, and are probably characterized by a somewhat lower hydraulic conductivity.

Prior to development of the aquifer, the water table probably sloped from east to west with groundwater flowing toward and discharging into the Ohio River; the exact configuration of the water table and the depth to water are not known, however. Pumping of wells has caused the water table to drop below the level of the river. As a result, water is now being pulled from the river into the aquifer, and is flowing in the direction of pumping centers (see Figure 11 and Table 5). Therefore, under present pumping conditions, the water-table aquifer is receiving recharge from both infiltrating precipitation and the Ohio River. Assuming an average annual precipitation of 43 inches and an infiltration of 20 to 50 percent of total precipitation, estimated infiltration ranges from 400,000 to 1,000,000 gallons per day per square mile. The area of land receiving infiltration-recharge that may eventually reach PPG's wells is probably less than two square miles; therefore, about two mgd or less of PPG's groundwater consumption is recharged by precipitation. Consequently, the Ohio River must be

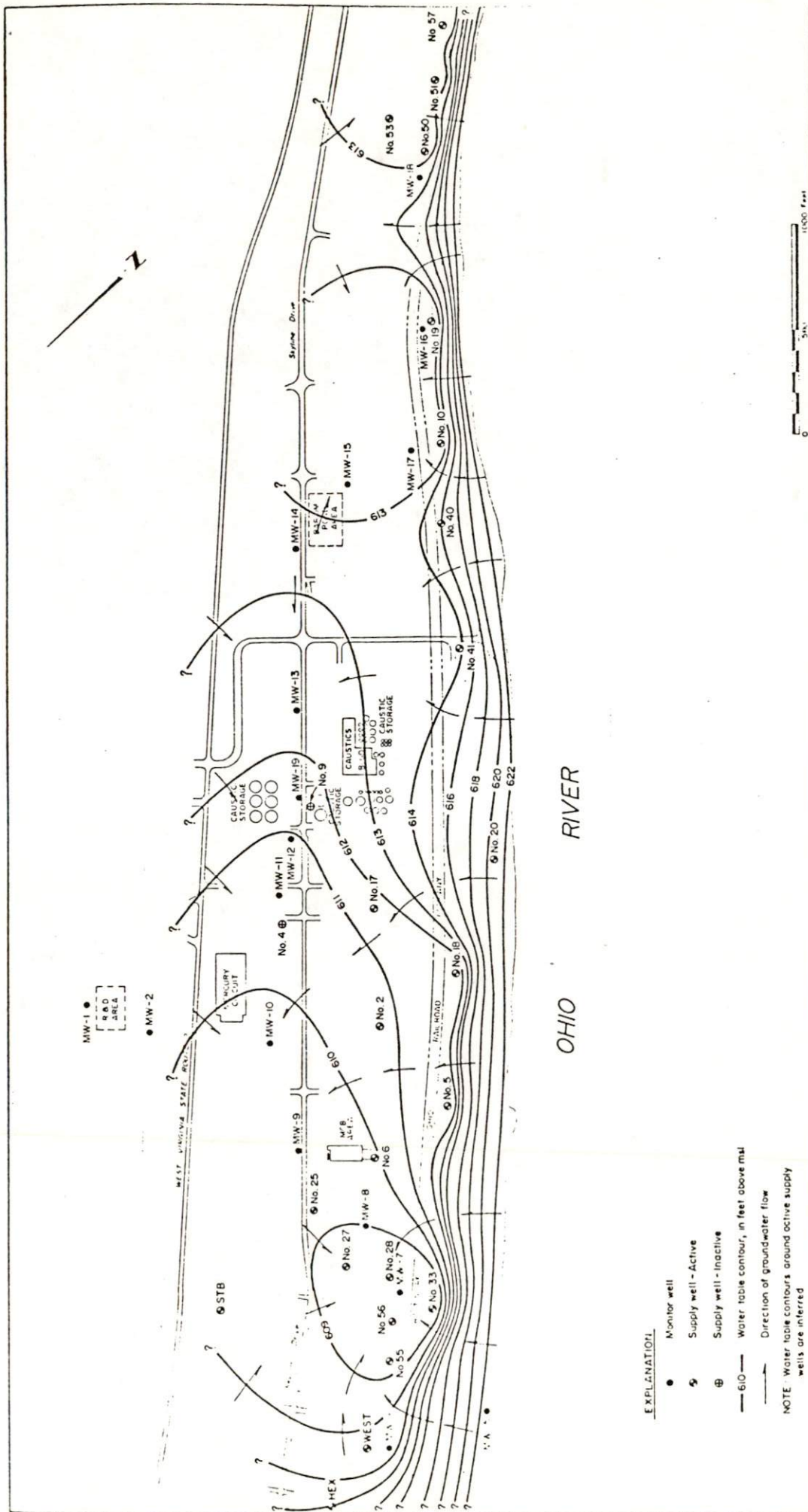


Figure 11. Water-Table Contour Map and Groundwater Flow Patterns at PPG, Natrium, West Virginia (Based on 09-28-81 Monitor Well Water Level Data)

Table 5. Water Level Data for Monitor Wells
 MW-1 through MW-19 and the Ohio River
 (measurements taken 09-28-81)

Monitoring Point	Elevation at Top of PVC Casing (ft. above MSL)	Depth to Water Below Top of PVC (ft.)	Elevation of Water Table (ft. above MSL)
MW-1	690.99	36.19	654.80
MW-2	687.44	77.17	610.27
MW-3	640.30	19.92	620.38
MW-4	637.16	17.53	619.63
MW-5	629.57	7.43	622.14
MW-6	646.89	36.16	610.73
MW-7	654.58	45.91	608.67
MW-8	657.86	48.85	609.01
MW-9	668.46	58.97	609.49
MW-10	673.59	63.71	609.85
MW-11	671.56	61.12	610.44
MW-12	673.02	62.08	610.94
MW-13	667.56	55.28	612.28
MW-14	649.10	36.00	613.10
MW-15	646.01	33.75	612.26
MW-16	640.18	27.75	612.43
MW-17	641.85	29.66	612.19
MW-18	641.87	28.36	613.51
MW-19	667.92	56.36	611.56
Ohio River	NA	NA	app. 624

NA - Not applicable

supplying at least 60 percent or more of the groundwater consumed by PPG; otherwise, the aquifer could not sustain the five mgd that is presently being withdrawn.

Aquifer recharge from the Ohio River is reflected by the steep hydraulic gradient along the plant/river boundary. Based on the groundwater flow patterns indicated on the water-table contour map (Figure 11), there is no apparent natural discharge of groundwater to surface-water bodies in the vicinity of PPG's main plant.

Observed fluctuations in the temperature of groundwater samples collected from supply wells may be a further indication of inflow from the Ohio River. In aquifers receiving recharge mainly from precipitation, groundwater temperatures tend to remain fairly constant throughout the year, and are generally about the same as the average annual air temperature. However, at the PPG site, samples collected over the past two years from many of the supply wells have exhibited inconsistencies in temperature (for a given well). The most plausible explanation is that surface water, which does experience a significant degree of seasonal variation in temperature, is being pulled into the water-table aquifer.

In addition to the water-table aquifer, the plant site is also underlain by a bedrock aquifer system at a depth of about 160 feet. In the mid-to-late-1950s, PPG installed several wells into this aquifer to determine its potential as a drinking water source. However, well yields were low (3 to 15 gpm), and natural groundwater quality was undesirable due to high TDS concentrations (Charles Drum, personal communication, 1981). Consequently, the wells were taken out of service and PPG has made no further attempts to develop the bedrock aquifer.

PROPOSED WELL INSTALLATION AND SAMPLING AND ANALYSIS PLAN FOR THE
PPG MERCURY POND

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- 1.0 Background Information
- 2.0 Well Installation and Sampling and
Analysis Plan
 - 2.1 Introduction
 - 2.2 Well Installation Plan
 - 2.3 Sampling and Analysis Plan
- 3.0 Summary
- 4.0 References

1.0 BACKGROUND INFORMATION

The surface impoundment at PPG's Natrium, West Virginia, plant site was initially used (from 1943 until about 1960) as a storage basin for sodium chloride brine produced from deep wells tapping Silurian-age deposits. During this period, the impoundment was concrete lined. After more than a decade of retirement, the facility was refurbished and equipped with a low-permeability synthetic liner, and has been used since 1970 to contain waste flow from the plant's mercury cell, chlorine circuit. Fluids currently entering the pond have a brine-type composition, and are characterized by a high pH (11.5 to 12.0) and appreciable concentrations of dissolved mercury (350 micro-gram/liter range). The mixed mercury waste within the pond is precipitated as mercury sulfide and the resultant clarified liquid is treated via carbon filtration prior to discharge into the Ohio River. The Mercury Pond is periodically cleaned and the liner has been replaced once.

The Mercury Pond facility is situated upon naturally high ground located immediately adjacent to the east valley wall of the Ohio River. Beneath this area, the alluvial aquifer (the uppermost water-bearing unit) abruptly pinches out (or becomes very thin) against the steeply rising bedrock deposits of the valley wall. Owing to these conditions, the monitor-well boring installed topographically upgradient from the Mercury Pond (GM-3) failed to intercept the uppermost aquifer; i.e., bedrock was encountered at an elevation higher than the water table. This necessitated the use of an alternative sampling location (GM-0) to characterize background-water quality at the Natrium site.

The GM-0 (or STB) well, also referred to as the "reference" well, is a plant pumping well and is located roughly two thousand feet west of the Mercury Pond, toward the Ohio River. In selecting this well to represent background-water quality, several important criteria had to be met. The well had to be situated so as not to intercept groundwater emanating from beneath the Mercury Pond and water produced from the well should represent natural aquifer fluids, and not induced recharge from the Ohio River. Unfortunately, site geologic conditions did not permit compliance with another important criterion;

namely, the background well and the three downgradient monitor wells (GM-1, GM-2, and GM-6) should be installed into deposits of similar lithology. Downgradient wells are installed through predominantly silt- and clay-rich materials largely derived from weathering and mass-wasting of the valley wall (rock fragments are common); whereas, deposits beneath the GM-0 location are probably comprised mainly of clean sand and gravel representing glacial outwash (geology beneath the GM-0 location is inferred by nearby wells for which logs are available).

Results of the groundwater monitoring program conducted under 40 CFR 265 Subpart F (detection monitoring) indicate a statistically significant difference in water quality between the background and the downgradient wells; specifically, downgradient Wells GM-1, GM-2, and GM-6 contain higher concentrations of TOC and are characterized by higher specific conductivities than were observed in the GM-0 background well. However, supplemental water-quality data generated throughout the course of 1982 detection monitoring (Table 1), and recent data generated as a result of this water-quality assessment program (Table 2), suggest that:

- 1) Higher-than-background TOC levels in downgradient monitor wells are probably reflective of differences in lithology between the background and the downgradient monitoring areas, and
- 2) Significantly higher SC levels in downgradient wells are probably related to seepage that occurred several decades ago, when the pond existed as a cement-lined brine storage facility.

The specific rationale behind these interpretations are discussed in more detail within the following sections.

TOTAL ORGANIC CARBON ANALYSES

Total Organic Carbon (TOC) values in groundwater can reflect natural, as well as artificially induced, sources of organic carbon. In uncontaminated groundwaters, natural TOC levels typically range from <5 to 10 or more milligrams per liter (mg/l), but values of several times these amounts are not uncommon in systems containing relatively abundant quantities of organic matter (e.g., peat).

In general, clays and other fine grained sediments normally tend to contain a greater proportion of organic matter than is usually present in sands and coarse grained deposits. This trend, in part, probably reflects differences in energies of depositional environments. In relatively low-energy, clay-depositing environments, sediments generally experience lesser degrees of winnowing and reworking than occur in relatively high energy, sand-and gravel-depositing environments. Also, organic matter may be less readily decomposed in clay and silt deposits than in sands, because of reduced aeration (and oxidation) within fine-grained sediments.

Average TOC values determined during 1982 detection monitoring of downgradient monitor wells GM-1, GM-2, and GM-6, were 17, 7 and 10 mg/l, respectively, as opposed to an average of about 3 mg/l in the GM-0 background well (Table 1). In data from the recent water-quality assessment program (Table 2), average TOC values were 8.6, 4.4, and 6.5 mg/l in the three downgradient wells and 1.3 mg/l in the background well; the average TOC level for Mercury Pond fluids was about 4 mg/l. All of the recorded TOC values are thought to be within a natural range.

Based on the analytical results presented in Table 2, the Mercury Pond does not appear to represent a likely source for higher-than-background TOC levels in downgradient wells, because fluids contained in this impoundment are characterized by appreciably lower TOC values than are typically found in groundwater sampled hydraulically downgradient from the Mercury Pond facility. Because PPG has not stored or disposed of any synthetic organic compounds in the Mercury Pond area (as evidenced by low TOX values in Table 1 as well as the organic analysis presented in Table 3), it is reasonable to hypothesize that differences in TOC levels between the background and the downgradient wells reflect natural variations in groundwater quality that result from differences in lithology; i.e., downgradient wells are installed into clay- and silt-rich deposits whereas the background well is constructed in predominantly sand and gravel deposits. Also, downgradient monitor wells are located in relatively close proximity to valley wall bedrock deposits and associated layers of coal, a concentrated TOC source material and coal fragments were noted in several of the lithologic logs prepared from downgradient well borings.

Based on these findings, TOC and TOX are not likely to be viable parameters for the detection of leakage.

SPECIFIC CONDUCTANCE ANALYSES

Specific conductance (SC) is a measure of the ability of a fluid to conduct an electrical current (expressed in micro-mhos per centimeter), and is an indication of the ion concentration in a solution; as the ion concentration increases SC also increases. Inspection of averaged 1982 monitoring data presented in Table 1 indicates that significantly higher SC levels in downgradient monitor wells primarily result from higher-than background levels of sodium, and to a lesser extent, chloride, magnesium, and iron. Bicarbonate also appears to be elevated in downgradient wells; however, this ion is less closely related to SC (Hem, 1970), and it is uncertain how bicarbonate may influence observed SC trends.

Natural sources of sodium in groundwater include sodium-bearing minerals like plagioclase feldspar and halite (which also represents a main chloride source). However, sodium levels in downgradient wells are more than an order-of-magnitude higher than found in the GM-0 background well, and it seems unlikely that a difference of this magnitude can be totally attributed to natural variations in groundwater quality between the background and downgradient monitoring areas.

Comparisons of analytical data presented in Table 2 also tend to rule out the Mercury Pond as a probable source for relatively high sodium and chloride levels in downgradient wells. If the Mercury Pond had been losing fluids to the underlying aquifer system, particularly in an area where the aquifer is not very extensive, it is expected that groundwater receiving this seepage would begin to acquire quality traits reflective of the composition of the effluent. As can be seen in Table 2, groundwater obtained from downgradient monitor wells has a vastly different chemical makeup from that found in Mercury Pond fluids. In particular:

- Downgradient monitor wells exhibit a near-neutral pH (7.0 to 7.3); whereas, fluids in the Mercury Pond have a very high pH (11.6 to 12.0)
- Dissolved mercury is present at appreciable levels in pond fluids (about 350 ug/l), but is essentially absent in downgradient monitor wells

- Mercury Pond brine contains high concentrations of sodium and chloride with Na/Cl ratios ranging from 0.72 to 0.76 (typical of a NaCl source); whereas, groundwater in downgradient wells has substantially greater proportions of sodium relative to chloride, with Na/Cl ratios ranging from 1.6 to 6.8

The latter observation is especially important in discounting the Mercury Pond as a probable cause of water-quality differences in downgradient wells. Because natural source materials for sodium and chloride are not believed to be abundant in the alluvial aquifer system, it is reasonable to expect that Na/Cl ratios in groundwater receiving brine-type effluents would gradually become similar to that of the brine, even though ion concentrations may be substantially lower; i.e., brine effluent entering the system would probably have a significant enough contribution to the overall sodium and chloride levels that it would tend to control Na/Cl ratios.

The above reasoning would also rule out past brine storage practices (i.e., 1943 until about 1960) as a likely source of relatively high sodium and chloride levels in downgradient wells. However, it is important to keep in mind that seepage from the old facility would have been eliminated more than 20 years ago (when the facility was initially closed) and it is possible that natural mechanisms operating within the subsurface system have acted to change the relative proportions of sodium and chloride ions that were introduced via brine seepage.

One possible explanation for how such a change might occur relates to differences in the retardation factors for chloride and sodium. The chloride ion, owing to its small size and negative charge, behaves very conservatively within the groundwater system, i.e., it is not readily removed from solution via sorption or precipitation, and is potentially very mobile (relative to other ions). Sodium is also fairly conservative, compared to other cations, but is considerably more subject to attenuation than the chloride ion. This is largely because sodium is adsorbed onto mineral surfaces having appreciable cation exchange capacities (e.g., clays) (Hem, 1970), especially at high concentrations where the sodium ion may tend to replace other adsorbed cations (e.g., calcium and magnesium). Consequently, it is reasonable to assume that a clay-rich system receiving brine effluents would tend to preferentially retain

sodium, relative to chloride. It also follows that, once the source of effluent is eliminated, chloride ions should be flushed from the system more readily than the adsorbed sodium ions.

A related, possible explanation for why sodium is now back into solution (i.e., a dissolved groundwater constituent) at higher-than-background levels is that dissolved sodium ions, having been preferentially adsorbed onto clays when introduced at high levels (i.e., during brine seepage), have dropped in concentration (due to source elimination) to a point where adsorbed sodium is now being replaced by more strongly attracted cations. This condition is roughly analogous to the operation of a water softener, where the adsorbing medium, having been flushed with a high sodium solution to replace calcium and other cations, begins to release sodium as hardness-contributing parameters are adsorbed back onto the medium.

Because of the persistent presence of past salt contamination, monitoring for sodium, chlorides or specific conductivity will likely result in false positives and consequently these are not valid parameters for monitoring the mercury impoundment.

TABLE 1.
AVERAGED RESULTS OF WATER-QUALITY ANALYSES CONDUCTED DURING 1982 DETECTION MONITORING
AT THE PPG MERCURY POND
(averages represent mean of 1/4/82, 5/10/82, 8/3/82, and 11/15/82 water-quality data;
all values are expressed in mg/l unless otherwise specified)

Well Number	pH (Std. units)	SC (umhes/cm)	TUC	TOX (ug/l)	TDS	Total ALK. (as CaCO ₃)	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	Hg (ug/l)	Na/Cl
GI-0	7.1	618	3	49	399	287	350	21*	80	11	2	108	11	0.1	<0.01	<0.2	0.5
GI-1	7.2	995	17	77	619	506	617	25	4	136	2	116	32	29	1.5	<0.5	7.5
GI-2	7.1	1249	7	48	779	504	615	69	9	245	5	107	25	11	2.7	<0.5	3.9
GI-6	7.2	896	10	26	585	259	317	68	123	130	5	103	15	6	2.1	0.4	2.1

* Median value used because of anomalously high result in 1/4/82 analysis.

TABLE 2.
RESULTS OF CHEMICAL ANALYSES CONDUCTED DURING THE PHASE I WATER-QUALITY ASSESSMENT
AT THE PPG MERCURY POND
(all values are expressed in mg/l unless otherwise specified)

Well Location	pH (std. units)	SC (micro/cm)	TOC	TDS	Total ALK. (as CaCO ₃)	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg	Fe	Mn	SiO ₂	Hg (ug/l)	As/C1
<u>10/19/83 Sample Set</u>																	
GM-0	6.9	678	1.2	425	212	259	19	84	-	-	-	-	-	-	-	-	-
GM-1	7.1	1158	9.0	650	602	734	18	<10	122	1.4	100	29	0.1	1.0	11.5	<0.5	6.8
GM-2	7.0	1355	5.7	758	596	727	79	<10	172	3.0	99	23	0.9	1.7	13.4	<0.5	2.2
GM-6	7.3	1050	7.4	635	207	253	61	188	97	2.7	98	16	<0.1	0.7	8.5	<0.5	1.6
Hj Pond	11.6	91625	4.0	85950	1424	1737	49000	1640	35200	19.4	13	<1	<0.1	<0.02	31.4	347	0.72
<u>10/27/83 Sample Set</u>																	
GM-0	7.1	719	1.4	485	202	246	27	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1178	8.1	675	599	731	49	<10	123	1.5	103	28	10.7	1.1	11.8	0.5	2.5
GM-2	7.0	1369	3.1	743	579	706	84	<10	203	3.2	92	21	5.1	1.5	13.8	<0.5	2.4
GM-6	7.2	1055	5.5	610	202	246	69	177	X	X	X	X	X	X	X	X	X
Hj Pond	12.0	61500	3.9	52400	5854	7142	29000	840	22000	17.4	16	1	0.1	<0.02	19.3	350	0.76
<u>Mean Average of 10/19/83 and 10/27/83 Data</u>																	
GM-0	7.0	699	1.3	455	207	253	23	84	-	-	-	-	-	-	-	-	-
GM-1	7.2	1168	8.6	663	601	733	34	<10	123	1.5	102	29	5.4	1.1	11.7	<0.5	3.6
GM-2	7.0	1362	4.4	751	588	717	82	<10	188	3.1	96	22	3.0	1.6	13.6	<0.5	2.3
GM-6	7.3	1053	6.5	623	205	250	65	183	97*	2.7*	98*	16*	<0.1*	0.7*	8.5*	<0.5*	1.6*
Hj Pond	11.8	76563	4.0	69175	3639	4440	39000	1240	28600	18.4	15	<1	<0.1	<0.02	25.4	349	0.73

- Not analyzed

X Insufficient sample volume for analyses

* Value based entirely on 10/19/83 data

TABLE 3
Organic Analysis of the Hg Pond and Downgradient Wells

	<u>TOC</u> (Analysis in ppm)		
	<u>8/3/83</u>	<u>10/19/83</u>	<u>10/27/83</u>
Hg Pond	--	4.0	3.9
GM-1	12	9.0	8.1
GM-2	--	5.7	3.1
GM-6	--	7.4	5.5

	<u>Halo-Org & Benzene</u> (analysis in ppb)		Natrium Mercury Pond
	<u>8-3-83</u>	<u>EPA</u>	
	<u>GM-1</u>	<u>GM-6</u>	<u>3/23/84</u>
Methylene Chloride	10	11.1	4
Trans-1,2-Dichloroethane	ND	ND	<1
Chloroform	.916	1.60	6
Cis-1,2-Dichloroethane	25.4	53.4	<1
Carbon Tetrachloride	1.27	2.12	<1
Benzene	4.10	7.0	20
Trichloroethane	10.7	24.2	3.0
1,1,2-Trichloroethane	11.0	24.5	<1
Tetrachloroethane	28.9	26.0	3
Bromoform	3.40	5.91	<1
1,4-Dichlorobenzene	5.0	8.0	<10
1,2-Dichlorobenzene	10.1	15.7	<10
1,1-Dichloroethane	ND	ND	<1
1,1,1-Trichloroethane	.688	ND	<1
1,2-Dichloroethane	25.4	53.4	<1
Monochlorobenzene	ND	ND	<10
1,1,2,2-Tetrachloroethane	ND	ND	<10
1,3-Dichlorobenzene	ND	ND	<10
Hexachloroethane	ND	ND	<10
1,2,4-Trichlorobenzene	ND	ND	<10
1,2,3-Trichlorobenzene	ND	ND	<10
Unknowns			<10
Volatiles	ND	ND	
Aromatics	ND	ND	

ND = none detected

Analytical method on following laboratory report

2.0 WELL INSTALLATION AND SAMPLING AND ANALYSIS PLAN

2.1 INTRODUCTION

In the review of the detection monitoring data from the Mercury Pond, PPG recognized that the comparison of the background well (GM-0) with the three downgradient monitor wells (GM-1, GM-2, and GM-6) may result in false positives with respect to the monitored parameters. Recent comments from State regulators also convey this concern as well as a concern with the placement of the three downgradient monitor wells which the state alleges may not insure immediate detection of effluent releases from the Mercury Pond facility. Finally, on March 8, 1984, the U.S. EPA filed a complaint against PPG pursuant to RCRA essentially adopting the position of the State on well locations and further alleging violations of procedural requirements under RCRA.

In order to resolve these concerns, avoid litigation and prolonged proceedings, and create a reasonable monitoring program acceptable to all parties, PPG agreed to prepare a modified plan which would address the agencies' concerns and result in a plan more specifically tailored to the facts at the mercury pond.

2.2 WELL INSTALLATION PLAN

PPG proposes another attempt to establish a background monitor well topographically upgradient from the Mercury Pond. Although PPG and its consultant made a reasonable judgment in 1981 that the water table was not accessible in this area, this action will satisfy the concerns of the state and EPA that PPG "insure" that no topographically upgradient well is possible. To achieve this, PPG will install two additional wells straddling the original upgradient well GM-3 in the area above the pond (See Figure I - Points A & B).

Installation of these two additional wells topographically upgradient is an attempt to discover a discrete section (i.e., an incursion of the water table on the bedrock) with a sufficient yield for sampling. These wells are expected to be dry and unsuitable for monitoring, but will provide assurance that no upgradient well is possible in the immediate vicinity of the pond.

If these wells fail to produce an adequate groundwater supply for monitoring purposes, an alternative location will be selected for the installation of the background well. This alternative background well location will be somewhere along the base of the valley wall, north of the pond, in the same aquifer as the downgradient well and far enough from the pond to insure that the aquifer is not affected by extraneous constituents or the pond itself (See Figure 1 - Point C).

One of these three wells will be selected for background monitoring depending on yield and conditions.

The agencies also raised a concern about whether two of the existing three downgradient wells (GM-1 and GM-6) were too far apart. PPG feels that these wells are adequate to detect any leaks from the pond, but to satisfy these concerns, an additional well will be installed roughly midway between existing wells GM-1 and GM-6 (See Figure 1 - Point D). Since there has also been concern on the part of the state of any perched water zones, a neighboring, shallow well will also be installed if a perched zone is encountered during drilling of the deeper well (See Figure 1 - Point E).

All of the new deep wells would be installed to bedrock; well depths are anticipated to be about 50 feet at the upgradient locations (Figure 1 - Points A&B) and about 90 feet at the other locations (Figure 1 - Points C&D). These wells will be constructed using two-inch-diameter PVC casing and well screen, and will be fully penetrating (i.e., screened from the top of the water table down to bedrock - See Figure 2).

Monitor wells will utilize formation collapse and/or clean silica sand as the screen pack material. This pack shall extend at least 10 feet above the top of the well screen. The screen pack shall be capped with a plug (at least one-foot thick) of bentonite, or bentonite and neat cement to prevent seepage of surface fluids into the well. Formation cuttings will then be used to fill the borehole annulus to a level at least five feet below ground, and a cement plug will be installed up to ground level. All above-ground well casing shall be protected with steel covers.

PPG will continue to use the existing monitor wells which have been utilized for RCRA compliance to date. These include downgradient monitor wells GM-1, GM-2, and GM-6 whose locations are shown on Figure 1. These wells are installed into alluvial deposits to depths of about 96, 99, and 75 feet, respectively, and are each equipped with a ten-foot-long screen section that intercepts the water-table aquifer (See Figure 2).

2.3 SAMPLING AND ANALYSIS PLAN

Facilities to be included in the sampling and analysis program include: existing downgradient monitoring wells GM-1, GM-2, and GM-6; the new deep downgradient monitor well (Figure 1 - Point D) and one of the new background wells (Figure 1 - Points A, B or C). All samples shall be collected in accordance with the document titled "Sampling and Analysis Plan for the PPG Mercury Pond, Natrium, West Virginia," which was prepared by Geraghty and Miller, Inc., in 1981 and submitted to both state and federal agencies.

As described in Section I (Background Information) the utilization of specific conductivity, TOX and TOC parameters cannot accurately characterize any leakage emanating from the pond and any attempt to use these parameters results in false positives under the applicable regulations. In initial discussions with EPA Region III, PPG indicated that sulfide might be a suitable parameter to analyze in downgradient monitoring wells to detect leakage. After further consideration, it appears this would not be a good choice. The pH range necessary for effective operation of the pond, necessitates maintaining the sulfide content between 0 and 1 ppm. Higher levels of sulfide form mercury polysulfides which are soluble. Most or all of this sulfide excess will be oxidized in the pond and would not reach the monitoring wells even if a leak occurred.

PPG proposes the use of two key chemical constituents which truly reflect the composition of the pond waters. These include:

pH - Since the fluids in the Mercury Pond have a very high pH (11.6 to 12.0); and,

Mercury - Since dissolved mercury is present at appreciable levels in the pond fluids (about 350 mg/l).

Evaluation response and reporting of this date will continue to follow the prescribed methods as specified under 40 CFR 265.93 and 265.94.

To examine the perched water zones, PPG also plans to monitor all existing shallow wells GM-3, GM-5 and GM-7, a new shallow well (Figure 1 - Point E) if a perched water zone is encountered while installing the new deep downgradient well, and any existing and active seeps adjacent to the pond. These samples will also be analyzed for both pH and mercury under the same program. Collection and evaluation of this data, however, will be dependent on adequate sample volumes. A summary of this program is presented in Table 4.

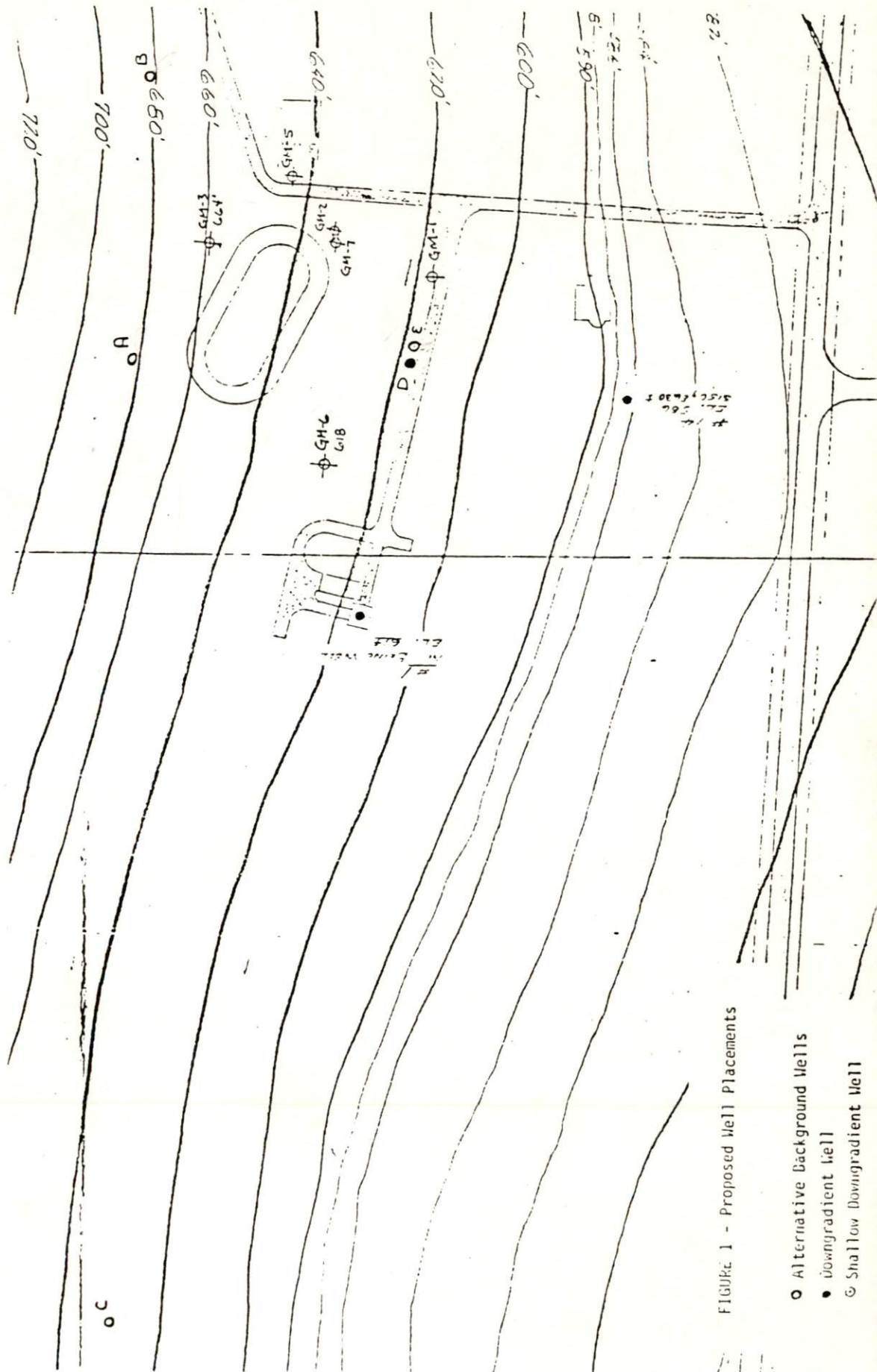
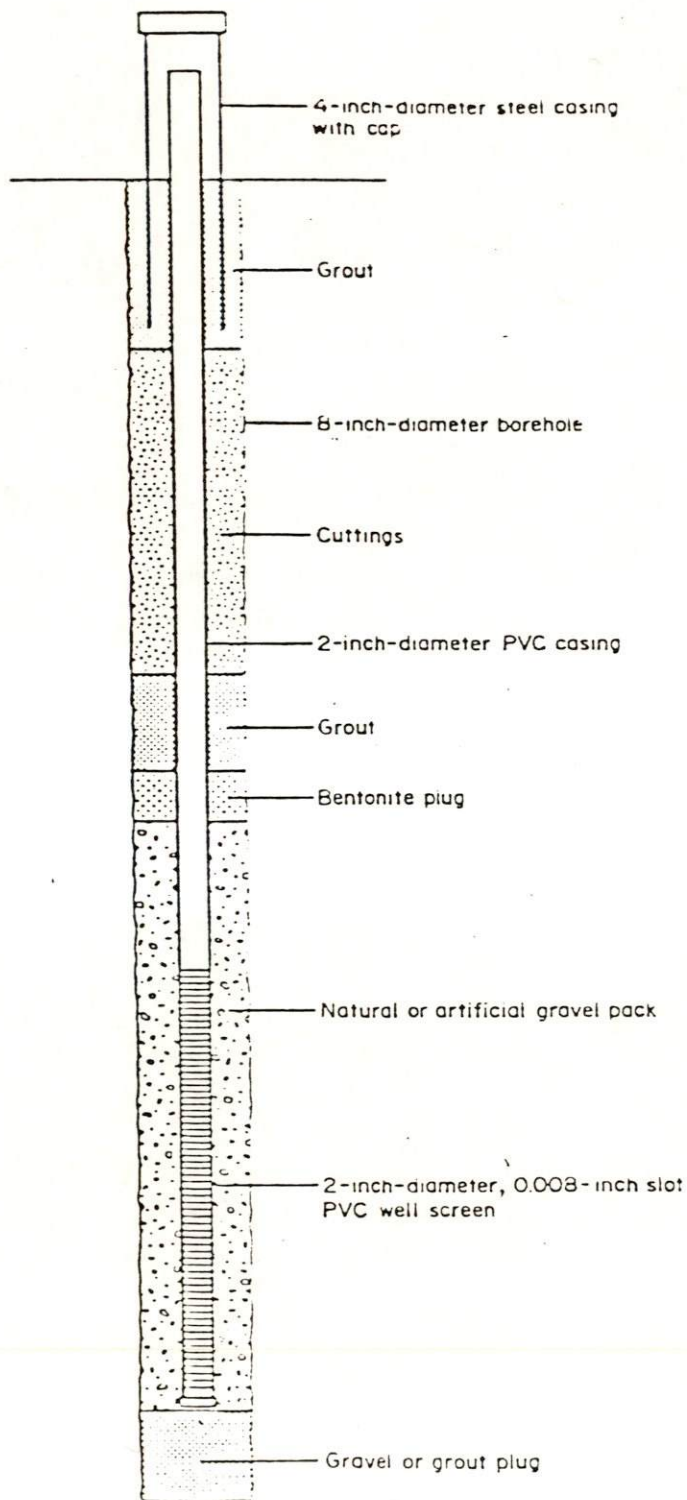


FIGURE 1 - Proposed Well Placements

- Alternative Background Wells
- Downgradient Well
- ⊙ Shallow Downgradient Well



Well Number	Elevation* (ft)	Total Depth* (ft)
GM-1	693.10	99
GM-2	709.88	102
GM-6	696.90	78

* Measurement from top of outer casing.

Figure 2. General Construction of Downgradient Monitor Wells, PPG, Natrium, West Virginia.

TABLE 4
SAMPLE COLLECTION AND ANALYSIS PLAN

Parameter	New Upgradient & Downgradient Wells	GM-1, GM-2, GM-6	GM-3, GM-5, GM-7, Seeps
<hr/>			
A. First Year			
pH	4 replicates each quarter	4 replicates each quarter	4 replicates each quarter
Mercury	4 replicates each quarter	4 replicates each quarter	4 replicates each quarter
B. Second Year			
pH	4 replicates twice/year	4 replicates twice/year	4 replicates twice/year
Mercury	4 replicates twice/year	4 replicates twice/year	4 replicates twice/year

3.0 SUMMARY

The primary objective of this modified monitoring plan is to address the concerns expressed by the state and federal agencies notwithstanding the fact that the current well system is, in PPG's opinion, adequate. To achieve this, a number of new wells will be installed. In addition, parameters selected in this proposed program were chosen as those constituents which could accurately characterize any potential leakage and eliminate false positives under the RCRA regulations.

The key components of this modified plan primarily consist of the following:

- Installation of two additional topographically upgradient wells in an attempt to discover a discrete section with sufficient water yield for sampling. These two wells are expected to be dry and unsuitable for monitoring, but will at least provide assurance that no upgradient well is possible in the immediate vicinity of the pond.
- Installation of one "upgradient" well to the north of the pond which should contain groundwater in the same aquifer and lithology as the downgradient wells, but which does not actually pass under the impoundment. One of these three upgradient will be selected for monitoring if yield and conditions are satisfactory.
- Installation of one downgradient well, essentially midway between two of the existing three wells (GM-1 and GM-6). This well will be completely screened in the aquifer/water table.
- If perched water is discovered during the installation of the deep downgradient well, a neighboring, shallow well shall be installed and monitored for mercury and pH.
- All existing and active seeps will be monitored for mercury and pH.
- With respect to the wells, rather than monitor for pH, specific conductivity, TOX and TOC, PPG will monitor for mercury and pH. Specific conductivity, TOX and TOC result in false positives and should not be part of any monitoring program.

4.0 REFERENCES

Geraghty & Miller, Inc., April 1981, Evaluation of Groundwater Quality Impacts at the PPG Mercury Pond, Natrium, West Virginia.

Hem, John D., 1970. Study and Interpretation of the Chemical Characteristics of Natural Water: U.S. Geological Survey Water-Supply Paper 1473, U.S. Government Printing Office, Washington, DC.

Krauskopf, Konrad B., 1967. Introduction to Geochemistry: McGraw-Hill Book Company, New York.

E - EPA
 S - STATE
 J - JOINT-E/S
 C - CONTR/EPA
 O - OTHER
 B - CONTR/STATE
 X - EPA OVERSIGHT

INVIOLATION TYPE:
☒ HAZARDOUS
☐ NON-HAZARDOUS

1. EPA ID: WV1D1010141313161314131
 2. FACILITY NAME: PPG Industries, Inc.
 3. ADDRESS: PO Box 191 New Martinsville, WV 26155

4. TYPE OF REPORT: ☒ NEW ☐ UPDATE SEQUENCE NUMBER: _____
 5. DATE OF INITIAL EVALUATION WHICH IS THE BASIS FOR THIS REPORT: 4/9/84 M D Y
 6. TYPE OF EVALUATION COVERED BY THIS REPORT: ☒ EVALUATION INSPECTION ☐ RECORD REVIEW ☐ SPECIAL INSPECTION
☐ SAMPLING INSPECTION

7. DATE OF EVALUATION COVERED BY THIS REPORT (enter only if different from 5): 4/9/84 M D Y

8. TYPE AND CLASS OF VIOLATION (enter number of violations by type and class):

Class of Violation	Area of Violation				Manifest	Other
	WHI	CI/PC	Fin. Reg.	Pt. D Comp. Sched.		
0						
I	1					
II				1		
III						

9. ENFORCEMENT ACTIONS

ACTION CODES	Class of VOL.	Area of VOL.	Type of Action	Compliance Dates (i.e.)		Penalty (\$000)	Agency	USE CODE E, S or ONLY
				Projected	Actual			
01 I S C L 02 3007 LETTER 03 3008 VIOLATING LTR/NOV 04 3008 COMPLIANCE COMPLAINT 05 3008 FINAL COMPLIANCE ORDER 06 3013 ADH. ORDER (INITIAL) 07 3013 ADH. ORDER (FINAL) 08 3003 ADH ORDER 09 STATE COMPLIANCE ORDER 10 INITIAL 11 CIVIL ACTION 12 CRIMINAL ACTION 13 MAY TO STATE	I	GWM	03	4/10/84				
	II	of B	03	4/10/84				

Resp. Agency: S

E - EPA
 S - STATE
 J - JOINT-E/S
 C - CONTR/EPA
 O - OTHER
 B - CONTR/STATE
 X - EPA OVERSIGHT

1. EPA ID: WV1D101014131316 214131
 2. FACILITY NAME: PPG Industries, Inc.
 3. ADDRESS: PO Box 191 New Martinsville, WV 26155

4. TYPE OF REPORT: ☒ NEW ☐ UPDATE SEQUENCE NUMBER:

5. DATE OF INITIAL EVALUATION WHICH IS THE BASIS FOR THIS REPORT: STATE 4/9/84

6. TYPE OF EVALUATION CONDUCTED BY THIS REPORT: ☒ EVALUATION INSPECTION ☐ RECORD REVIEW ☐ FOLLOW-UP
☐ SAMPLING INSPECTION ☐ SPECIAL INSPECTION

7. DATE OF EVALUATION COVERED BY THIS REPORT (enter only if different from 5): 1/1/84

8. TYPE AND CLASS OF VIOLATION (enter number of violations by type and class):

Class of Violation	Area of Violation				Manifest	Other
	WHI	CI/PC	Fin. Reg.	Comp. Sched.		
0	-	-	-	-	-	-
I	-	-	-	-	-	-
II	-	-	-	-	-	-
III	-	-	-	-	-	-

ACTION CODES	Class of VOL.	Area of VOL.	Type of Action	Date Action Taken (July)	Compliance Dates (July)		Penalty (\$000)
					Projected	Actual	
1 S C L							
0007 LETTER	II	OTHER	03	6-7-84	NONE - DEFERRED TO ENFORCEMENT FOR FURTHER ACTION		FOR USE WITH ACTION CODE 4 or 5 ONLY
0008 WARNING LTR/NOV							
0008 COMPLIANCE COMPLAINT							
0008 FINAL COMPLIANCE ORDER	III	OTHER	03	6-7-84	II		
0013 ADM. ORDER (INITIAL)							
0013 ADM ORDER (FINAL)							
0003 ADM ORDER							
STATE COMPLIANCE ORDER							
INFORMAL							
CIVIL ACTION							
MINIMAL ACTION							
GOV TO STATE							

Resp. Agency S

REGA COMPLIANCE SECTION
RECEIVED
JUN 15 1984

JUN 18 1984

WVD 00 433 6343



RECEIVED
LEGAL BRANCH

PPG Industries, Inc. One PPG Place Pittsburgh, Pennsylvania 15272

1984 APR 10 AM 9 35

Law Department
Writer's Direct Dial No.:

(412) 434-2406

U.S. ENVIRONMENTAL
PROTECTION AGENCY
REGION III

April 5, 1984

Douglas A. Donor
Environmental Scientist
U.S. Environmental Protection Agency
Region III
Sixth and Walnut Streets
Philadelphia, PA 19106

Re: PPG Industries, RCRA-III-096

Dear Mr. Donor:

Pursuant to your request, I am sending you a copy of the "Water Quality Assessment Plan for the PPG Mercury Pond, Natrium, West Virginia." This plan was prepared for PPG by Geraghty and Miller and represents the approach taken to the mercury impoundment during October, November and December of 1983.

Since EPA did not feel that PPG's October 11, 1983, outline was detailed enough, I am forwarding this document which more fully describes the assessment plan which was carried out by Geraghty and Miller. Please note that it incorporates the following two studies by reference:

- Evaluation of Groundwater Quality Impacts at the PPG Mercury Pond (April, 1981).
- Sampling and Analysis Plan for the PPG Mercury Pond, Natrium, West Virginia (April, 1981).

These two documents were provided to you at our meeting on April 2, 1984. Although I had a copy of the attached plan at that meeting, it was not a clean copy and did not contain a certification by Geraghty and Miller. For the sake of eliminating any perceived technical errors, I have had the attached copy certified.

In PPG's opinion, this document, along with the documents supplied to you at our meeting, provide a complete and adequate assessment plan under the

Douglas A. Donor
Page 2
April 5, 1984

regulations. To the extent there is a disagreement over the required level of detail and over the certification requirement, these documents, along with the final Geraghty and Miller report of December, 1983, clear up any problems. Continued enforcement and the fine on these procedural issues is unwarranted under the circumstances.

If you have any questions or problems, please do not hesitate to call.

Sincerely yours,



David C. Cannon, Jr.
Senior Attorney

DCC/eb

cc: R. Siskind, Esq.
(w/copy)

Hazardous Waste Monitoring And Enforcement Log

RESP. AGENCY
E - EPA
S - STATE
J - JOINT-E/S
C - CONTR/EPA
O - OTHER
B - CONTR/STATE
X - EPA OVERSIGHT

HANDLER TYPE:
☒ MAJOR
☐ MINOR

PPG

1. EPA ID: WV 0004336134131
2. FACILITY NAME: Pittsburg Plate Glass
3. ADDRESS: New Martinsville, WV

4. TYPE OF REPORT: ☐ NEW ☒ UPDATE ☐ FOLLOW-UP
SEQUENCE NUMBER: 2 OK

5. DATES OF INITIAL EVALUATION WHICH IS THE BASIS FOR THIS REPORT: START 5/9/84 H D Y

6. TYPE OF EVALUATION COVERED BY THIS REPORT:
☐ EVALUATION INSPECTION ☒ RECORD REVIEW ☐ SPECIAL INSPECTION
☐ SAMPLING INSPECTION

Resp. Agency E

7. DATE OF EVALUATION COVERED BY THIS REPORT (enter only if different from 5): / / H D Y

Type and Class of Violation (enter number of violations by type and class):	Class of Violation	Area of Violation				Manifest	Other
		GMH	CI/PC	Fin. Res.	Pt. B	Comp. Sched.	
0							
1							
II							
III							

9. ENFORCEMENT ACTIONS

ACTION CODES	Class of VOL.	Area of VOL.	Type of Action	Date Action Taken (m/d/y)	Compliance Dates (m/d/y)		Penalty (\$000)	USE CODE E, S or X ONLY
					Projected	Actual		
01 I S C L								
02 3007 LETTER								
03 3008 WARNING LTR/NOV								
04 3008 COMPLIANCE COMPLAINT								
05 3008 FINAL COMPLIANCE ORDER								
06 3013 ADM. ORDER (INITIAL)								
07 3013 ADM. ORDER (FINAL)								
08 7003 ADM ORDER								
09 STATE COMPLIANCE ORDER								
10 INFORMAL								
11 CIVIL ACTION								
12 CRIMINAL ACTION								
13 NOV TO STATE								

FOR USE WITH ACTION CODE 4 or 5 ONLY

\$ \$
\$ \$

COMMENTS:
(Use other)

WUD 00 433 6343

2873,

Geraghty & Miller, Inc.

NSA COMPLIANCE CENTER
RECEIVED

APR 13 1984

WATER-QUALITY ASSESSMENT PLAN FOR THE PPG MERCURY POND
NATRIUM, WEST VIRGINIA

Prepared for
PPG Industries, Inc.
Natrium, West Virginia

GERAGHTY & MILLER, INC.
844 West Street
Annapolis, Maryland

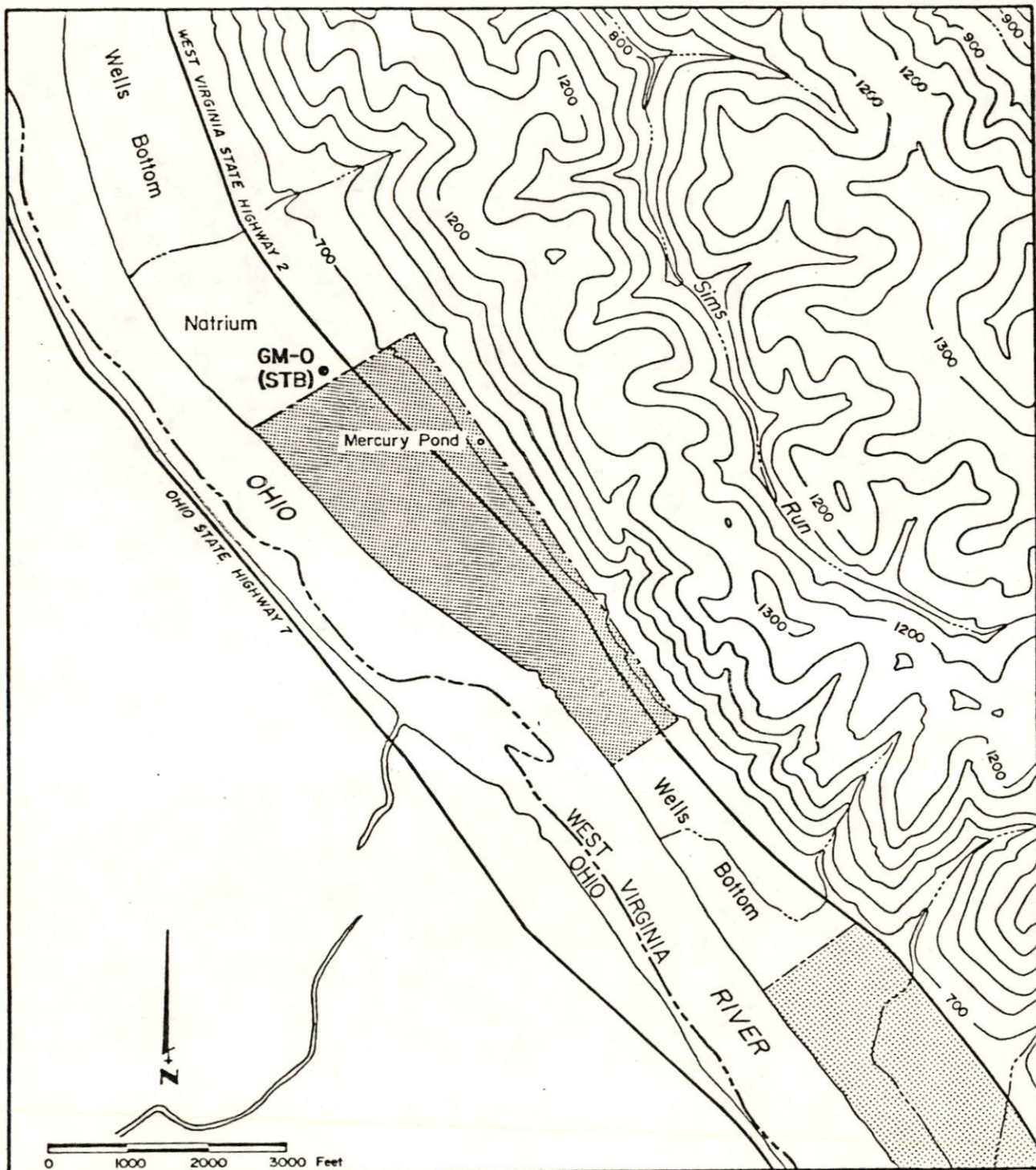
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INTRODUCTION

In accordance with Federal and State requirements for groundwater quality monitoring at hazardous waste management facilities (EPA 40 CFR, Part 265, Interim Status Standards) PPG Industries, Inc., in Natrium, West Virginia intends to conduct a groundwater quality assessment in the area of their mercury surface impoundment (Mercury Pond, Figure 1). Geraghty & Miller, Inc., was retained by PPG to develop and implement the groundwater quality assessment plan required by the regulations. The following document constitutes the required plan.

The impetus for conducting this assessment comes after collection of the first year of background water-quality data and subsequent statistical comparison of those data to the first semi-annual sampling results. These comparisons indicated a statistically significant difference in background versus downgradient quality for the indicator parameters total organic carbon (TOC) and specific conductance (SC). Confirmation sampling indicated that the statistically significant difference was not the result of laboratory error.



EXPLANATION



-  PPG INDUSTRIES, INC. MAIN PRODUCTION FACILITY
-  MOBAY CHEMICAL CO.

Figure 1. Location of the PPG Mercury Pond, Natrium, West Virginia.

Supplemental water-quality data generated throughout the course of the detection monitoring program suggest that these statistically significant differences for TOC and SC may not be related to holding practices at the Mercury Pond facility. In particular, statistically higher TOC levels are thought to reflect natural variations in fluid chemistry resulting from lithologic differences in aquifer matrix materials beneath the background and the downgradient monitoring locations, and statistically higher SC values are believed to be remnant from brine storage practices conducted at this site more than a decade prior to operation of the Mercury Pond. Because of these factors, PPG intends to implement a phased approach for conducting the water quality assessment.

The first phase (Phase I) of the water quality assessment will focus on determining if Mercury Pond holding practices are responsible for higher-than-background levels of TOC and SC in downgradient monitor wells. If findings indicate that the Mercury Pond is responsible, a second phase (Phase II) assessment will be implemented to determine, at a minimum: 1) the concentrations of specific hazardous wastes or hazardous waste constituents in the groundwater, and 2) the rate and extent of migration of hazardous waste or hazardous waste constituents within the aquifer system.

The plan used to accomplish Phase I (and Phase II, if required) of the water quality assessment specifies the following information:

- 1) the number, location and depth of wells used in the assessment;
- 2) sampling and analytical methods to be utilized;
- 3) evaluation procedures including any use of previously gathered groundwater quality information; and
- 4) a schedule of implementation.

The subsequent sections discuss the information requested above, as well as additional information that will be collected and evaluated to adequately define the relationship (if any) between downgradient water-quality trends and waste-holding practices at the Mercury Pond facility. For simplicity, these sections shall be presented as Phase I information requirements and Phase II information requirements. As noted earlier, the Phase II water quality assessment would only be implemented if Phase I findings indicated that the Mercury Pond is responsible for the statistically higher TOC and SC levels in downgradient wells, relative to background conditions.

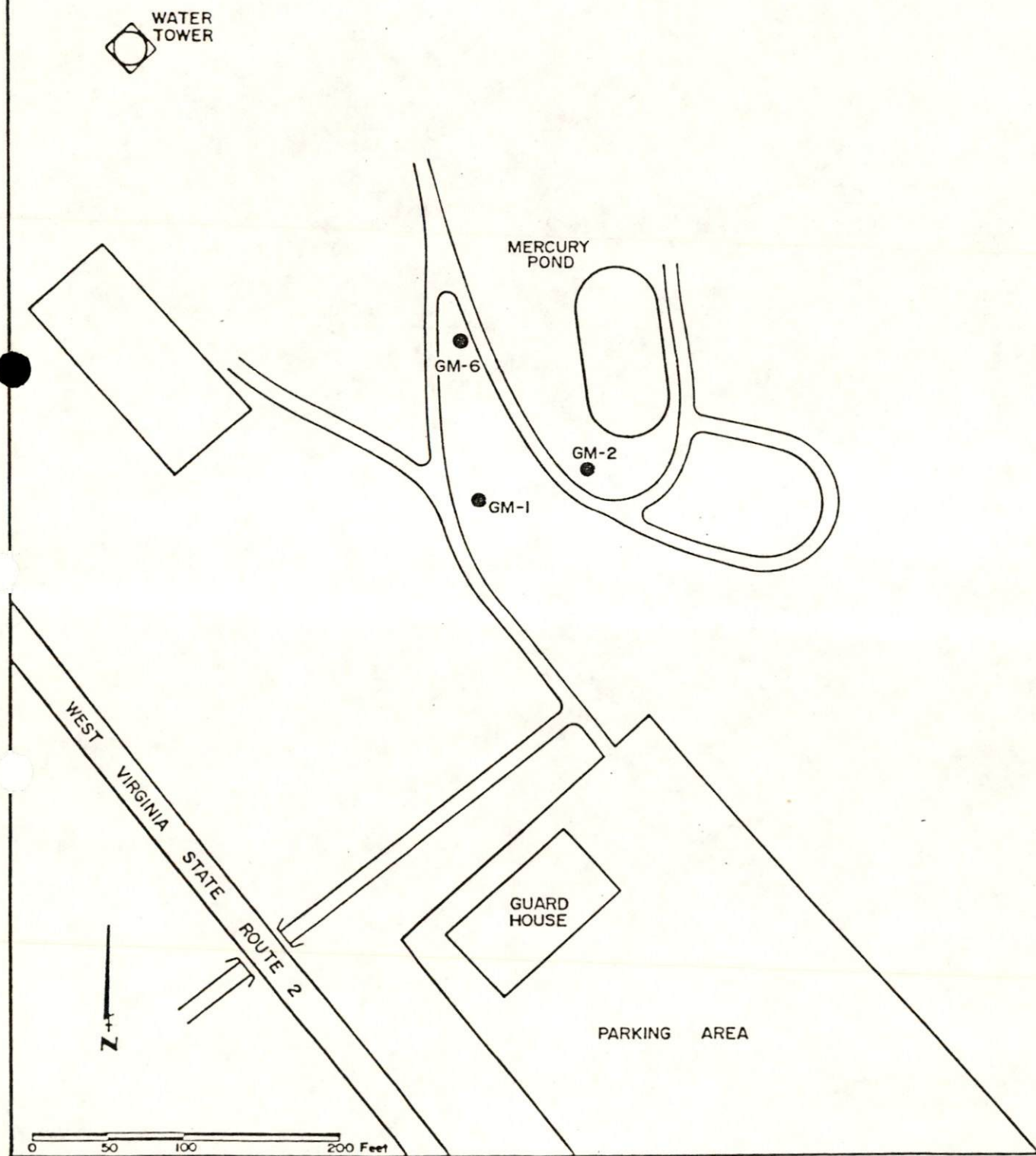
PHASE I WATER QUALITY ASSESSMENT

Objective

The primary objective of the Phase I water quality assessment is to determine if the Mercury Pond is responsible for higher-than-background levels of total organic carbon (TOC) and specific conductance (SC) in downgradient monitor wells GM-1, GM-2, and GM-6.

Number, Location, and Depth of Wells

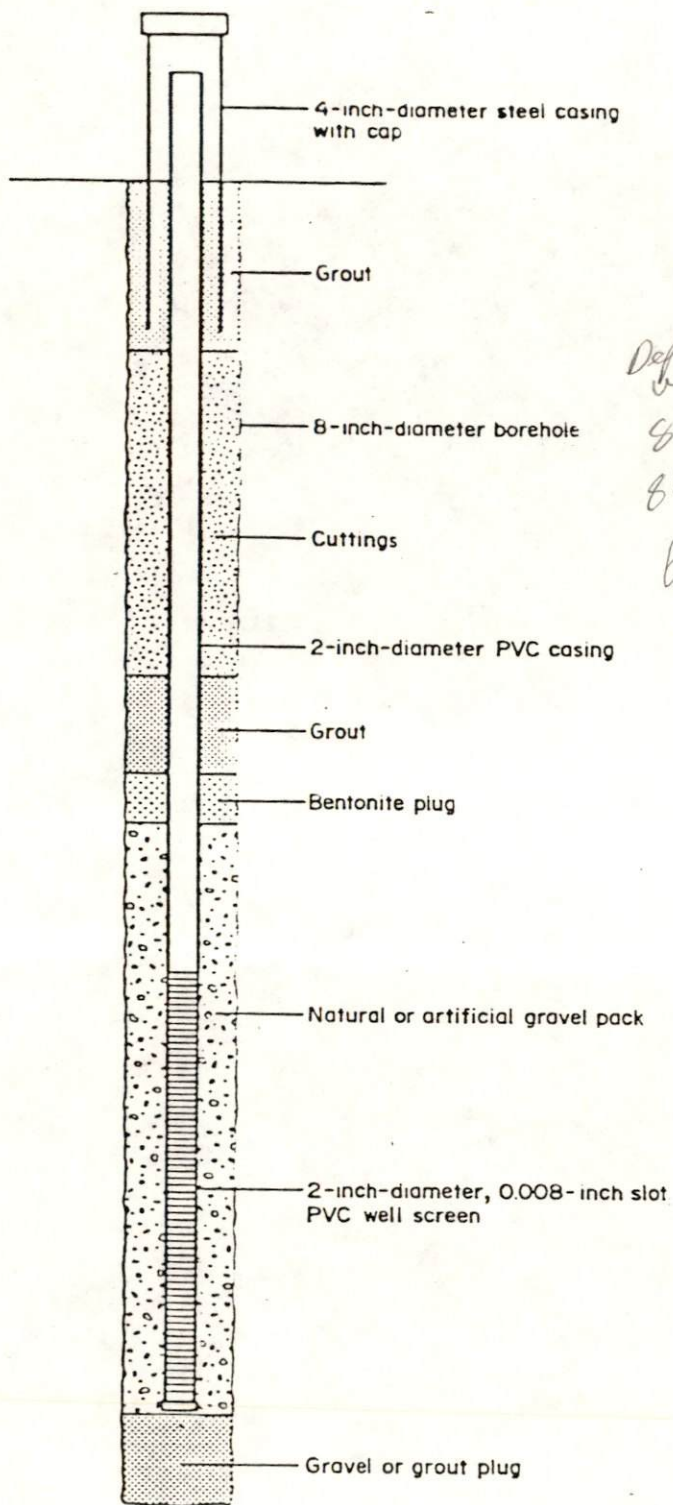
The existing monitor wells which have been utilized for RCRA compliance shall also be used to conduct the Phase I water quality assessment program. These include down-gradient monitor wells GM-1, GM-2, and GM-6; well locations are shown on Figure 2. These wells are installed into alluvial deposits to depths of about 96, 99, and 75 feet, respectively, and are each equipped with a ten-foot-long screen section that intercepts the water-table aquifer; general monitor well construction is indicated in Figure 3. Lithologic descriptions of materials encountered at each well location and other information regarding hydrogeologic conditions near the Mercury Pond are presented in the report titled "Evaluation of Groundwater Quality Impacts at the PPG Mercury Pond," which was submitted to PPG in April 1981.



EXPLANATION

- GM-2 Monitor well and number

Figure 2. Location of Downgradient Wells at the PPG Mercury Pond, Natrium, West Virginia.



Depth to water

Well Number	<i>9/82 water elev</i>	Elevation* (ft)	<i>Bottom Elev</i>	Total Depth* (ft)	<i>sat. Thick</i>
GM-1	<i>82'</i>	611.6	693.10	594.1	99 17.5
GM-2	<i>88'</i>	622.2	709.88	607.88	102 14.32
GM-6	<i>64'</i>	633.0	696.90	618.9	78 14.1

* Measurement from top of outer casing.

10' well screen

Figure 3. General Construction of Downgradient Monitor Wells, PPG, Natrium, West Virginia.

In addition to monitor well sampling facilities, fluid samples shall be collected from the discharge (inlet) pipe to the Mercury Pond. The location of the Mercury Pond facility is shown on Figure 1.

Sampling and Analytical Methods

Two sets of groundwater samples shall be collected from downgradient monitor wells GM-1, GM-2, and GM-6. In addition, grab samples of Mercury Pond fluid shall be collected (from the inlet pipe) on the same day that groundwater samples are collected. All samples shall be collected in accordance with the document titled "Sampling and Analysis Plan for the PPG Mercury Pond, Natrium, West Virginia", which was prepared by Geraghty & Miller, Inc., and submitted to PPG in April, 1981.

All groundwater and pond fluid samples shall be analyzed for important water quality parameters including (but not limited to): pH, specific conductance, total organic carbon, total dissolved solids, bicarbonate, chloride, sulfate, calcium, magnesium, sodium, potassium, iron, manganese, silica, and mercury. Chemical analyses for these parameters shall be performed in accordance with the methods listed in the Sampling and Analysis Plan cited above.

Evaluation Procedures

The evaluation procedures for conducting this water quality assessment are as follows:

- (1) Inspect water quality data (including supplemental data) generated throughout the course of the detection monitoring program. Parameters that were analyzed in addition to pH, SC, TOC, and TOX include: TDS, total alkalinity, bicarbonate, chloride, sulfate, sodium, potassium, calcium, magnesium, iron, manganese, and mercury.
- (2) Identify parameters and/or parameter relationships that appear to relate to TOC and SC trends in downgradient monitor wells, and establish chemical parameters to be analyzed in subsequent water samples.
- (3) Collect two separate sets of water samples from the Mercury Pond (prior to treatment) and down-gradient monitor wells GM-1, GM-2, and GM-6.
- (4) Analyze both sets of water samples for the chemical parameters pH, specific conductance, TOC, TDS, bicarbonate, chloride, sulfate, calcium, magnesium, sodium, potassium, iron, manganese, silica, and mercury; these parameters have been selected based on findings from step (1), and in order to facilitate charge balance calculations to double check the overall accuracy of analytical results.
- (5) Evaluate results of chemical analyses from previously gathered and new water quality information, and identify specific parameters and parameter relationships (e.g., Na/Cl ratios, main contributors to SC, major and minor fluid constituents, pH, etc.) that characterize each fluid sample.
- (6) Compare the chemical makeup of Mercury Pond fluids with the chemical makeup of groundwater in down-gradient wells, and assess similarities and dissimilarities, and the extent to which the Mercury Pond may contribute to TOC and SC levels observed in downgradient monitor wells GM-1, GM-2, and GM-6.

- (7) If, from this evaluation, the Mercury Pond does not appear to be the cause of the statistically significant change, notify the EPA Region III Administrator within 15 days of the determination and resume the normal indicator evaluation program under 40 CFR 265.92 and 265.93(b).
- (8) If the Mercury Pond does appear to represent a likely source for higher-than-background TOC and/or SC levels in downgradient wells, implement the Phase II water quality assessment.
- (9) Prepare a report to EPA Region III documenting the relevant findings of the Phase I water quality assessment, including the specific rationale and supporting data used to interpret water-quality trends beneath the Mercury Pond area.

Schedule of Implementation

The tentative schedule for implementing the Phase I water quality assessment is as follows:

<u>Task</u>	<u>Time Interval</u>
1) Collect and analyze two sets of water samples from the Mercury Pond and from downgradient monitor wells GM-1, GM-2 and GM-6.	October 10, 1983 to November 28, 1983.
2) Evaluate results of water quality analyses and interpret and identify water quality trends and the relationship (if any) between Mercury Pond fluids and groundwater in downgradient wells GM-1, GM-2, and GM-6.	November 28, 1983 to December 5, 1983
3) Prepare a report to EPA Region III documenting findings of the Phase I water quality assessment.	December 5, 1983 to December 15, 1983

PHASE II WATER QUALITY ASSESSMENT

Objectives

The Phase II water quality assessment shall be conducted if results from the Phase I assessment indicate that the Mercury Pond is responsible for higher-than-background levels of TOC and SC in downgradient monitor wells GM-1, GM-2, and GM-6. If the Phase II assessment is implemented, The main objectives, at a minimum, will include:

1. determine the rate and extent of migration of hazardous waste or hazardous waste constituents in groundwater, and
2. determine the concentrations of the hazardous waste or hazardous waste constituents in the groundwater.

Number, Location, and Depth of Wells

Existing monitor wells utilized for RCRA monitoring shall be included in the Phase II water quality assessment. These include downgradient wells GM-1, GM-2, and GM-6; and the GM-0 background well. Information regarding the location, depth, and general design of downgradient wells is presented in the Phase I plan. One (or more) additional downgradient wells shall also be installed to facilitate the Phase II assessment. It is anticipated that the additional well(s) will be installed to a depth of approximately 90 feet and will be screened into the top of the alluvial

aquifer. The exact location(s) for the additional down-gradient well(s) shall be determined based on which existing downgradient well(s) is(are) contaminated; the rationale for selecting locations of additional wells is presented in the "Evaluation Procedures" section of this Phase II plan.

In addition to sampling monitor wells, fluid samples will be collected from the discharge pipe (pretreated) to the Mercury Pond and the discharge pipe from the Mercury Pond to the carbon filter.

Sampling and Analytical Methods

Fluid samples shall be collected from: existing down-gradient monitor wells GM-1, GM-2, and GM-6; new down-gradient monitor wells; the GM-0 background monitor well; and the discharge pipe to and the discharge pipe from the Mercury Pond. All samples shall be collected in accordance with the document titled "Sampling and Analysis Plan for the PPG Mercury Pond, Natrium, West Virginia", which was prepared by Geraghty & Miller, Inc., and submitted to PPG in April, 1981.

All fluid samples shall be analyzed for important water-quality parameters including (but not limited to): pH, specific conductance, total dissolved solids, total

alkalinity, bicarbonate, chloride, sulfate, sodium, potassium, magnesium, iron, manganese, silica, mercury, barium, cadmium, chromium (total), lead, total organic carbon, and total organic halogens; as well as other waste-specific parameters that may be recommended. All chemical analyses of fluid samples shall be performed in accordance with the methods listed in the Sampling and Analysis Plan referenced above.

Evaluation Procedures

If results of the Phase I water-quality assessment indicate that the Mercury Pond may be responsible for higher-than-background levels of TOC and SC in downgradient monitor wells (GM-1, GM-2, and GM-6), the Phase II water-quality assessment shall be implemented as follows:

- (1) Evaluate Phase I water-quality data and (to the extent possible) identify the specific parameters causing contamination in the downgradient monitor well(s).
- (2) Install additional downgradient monitor well(s). The location(s) of the additional downgradient monitoring well(s) is dependent upon which of the existing downgradient wells (i.e., GM-1, GM-2, and/or GM-6) are contaminated
 - a) If Well GM-2 or GM-6 is contaminated, additional monitor wells should be installed on either side of the affected well. In addition, monitor wells should be installed downgradient from the affected well(s). It may be necessary to install several sets of these downgradient wells to define the extent of contamination (see Figure 4 for potential locations).



WATER
TOWER

MERCURY
POND

GM-6

GM-2

GM-1

GUARD
HOUSE

PARKING AREA

WEST VIRGINIA STATE
ROUTE 2



0 50 100 200 Feet

EXPLANATION

● GM-2 Monitor well and number

▨ Potential location of additional monitor wells

Figure 4. Potential Locations for Additional Downgradient Monitor Wells at the PPG Mercury Pond, Natrium, West Virginia.

- b) If Well GM-1 is contaminated, additional monitor wells should be installed on either side of it. In addition, monitor wells should be installed on either side of GM-2, and one or more lines of monitor wells should be installed parallel to the terrace face and at least 20 feet west of GM-1. If more than one line of wells is installed west of GM-1, the well fronts should be at least 20 feet apart (see Figure 4 for potential locations).
 - c) The exact number and location of the additional monitor wells must be determined by the geologist or geotechnical engineer preparing the final Groundwater Assessment Plan.
- (3) The hollow-stem auger drilling method shall be used to install all new 2-inch I.D. PVC monitor wells. Ten-foot well screens should be installed across the water table, above the top of consolidated bedrock. The estimated depth to the top of the screen will be approximately 80 feet. Soil samples should be collected during construction of the borehole. The annular space around the screen should be gravel packed. A bentonite plug shall be set above the screen and the remaining annulus shall be filled with cuttings that will be capped with at least 5 feet of bentonite or grout.
 - (4) On a weekly basis, collect three sets of water-level and water-quality data (i.e., sampling and measurements shall be collected once every seven days, over a three-week period). These data shall be collected from existing downgradient monitor wells (GM-1, GM-2, and GM-6), the GM-0 background well, the Mercury Pond, and newly installed down-gradient wells. All samples shall be analyzed for the water-quality parameters specified in the Phase II Sampling and Analytical Methods section. All sampling and analysis procedures shall be in accordance with the Sampling and Analysis Plan referenced earlier.
 - (5) Via laboratory tests or pumping tests determine the permeability (hydraulic conductivity) of the earth material above and in the aquifer. These data will be needed to calculate groundwater flow rates.

- (6) Determine the elevation of water in all wells and prepare a map of the water table depicting the direction of groundwater movement and the hydraulic gradient.
- (7) Map results of water-quality analyses to determine the extent of groundwater contamination. Show concentration distributions for critical hazardous-waste constituents comprising the contaminated zone.
- (8) Using available data on flow direction, hydraulic conductivity, hydraulic gradient, or other factors, estimate the rate of movement of the contamination.

Schedule of Implementation (Section 265.93(d))

- (1) Within 30 days of the determination that the Phase II water-quality assessment must be implemented, begin installation of additional monitor wells.
- (2) Within 60 days after installation of additional monitor wells, have results of all analyses completed and prepare a report defining the Rate and Extent of contamination.
- (3) Within 15 days of completion of the report defining the Rate and Extent of contamination, report results to EPA Regional Administration.

Reassessments (Section 265.93(d))

- (1) On a quarterly basis determine:
 - a) The rate and extent of migration of hazardous waste or hazardous-waste constituents in groundwater, and
 - b) The concentrations of the hazardous waste or hazardous-waste constituent.

- (2) Reassessments must be made until the facility is closed.
- (3) As needed, install additional monitor wells to assure the ability for continued compliance with Section 265.93(d).

Reporting and Record Keeping (Section 265.94(a))

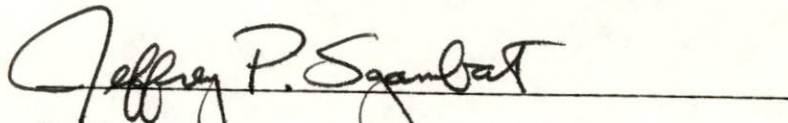
- (1) Annually report to the EPA Regional Administrator the results of the quarterly reassessments.
- (2) Maintain all records during life of facility and through the post-closure case period.

Respectfully submitted,

GERAGHTY & MILLER, INC.



Cleason P. Smith, C.P.G. (Virginia #50)
Staff Scientist



Jeffrey P. Sgambat, C.P.G. (AIPG #4932)
Associate